

ADMINISTRATIVE ASPECTS OF RIVER VALLEY DEVELOPMENT

by
HENRY C. HART

*Issued under the auspices of
The Indian Institute of Public Administration
New Delhi*



IIPA LIBRARY



4464



ASIA PUBLISHING HOUSE
BOMBAY • CALCUTTA • NEW DELHI • MADRAS
LONDON • NEW YORK

© THE INDIAN INSTITUTE OF PUBLIC ADMINISTRATION
NEW DELHI

1961

PRINTED IN INDIA

BY B.C. RAY AT THE I.M.H. PRESS PRIVATE LTD.
DELHI, AND PUBLISHED BY P.S. JAYASINGHE,
ASIA PUBLISHING HOUSE, BOMBAY 1.

FOREWORD

MANY river valley projects have been set up in India during the last 10 years for one or more purposes like flood control, production of electricity and irrigation. In fact, this has been one of the most important aspects of planned development of the country undertaken in recent times. Of them, the Damodar Valley Corporation set up in 1947 was the earliest and it is still one of the biggest. It was modelled upon the T.V.A. in the United States. In subsequent river valley projects this pattern, however, has not been widely used. In place of an autonomous corporation, the more flexible organization of a Control Board has been generally favoured by the Union Government.

Prof. Hart's monograph is an attempt to compare and evaluate river valley development in India and the U.S.A. The lectures were delivered at the Institute in December 1958, and they are a continuation of his earlier studies of *The Rivers of India* and his more recent book *Dark Missouri*. The lectures deal with the subject under five heads : "The River Valley Authority in India and America", "The Decision to Build", "Participation by the Users of Water and Power", "The Organization for River Valley Development", and "The River Valleys as Planning Units". Any reader of these pages will be impressed, as was the audience when they heard the lectures, by Prof. Hart's intimate knowledge of the subject and fine powers of exposition.

The Institute considers that the lectures are worthy of being printed in a book form in view of their intrinsic importance as well as the interest in the subject in India. The comparisons between India and the United States are certainly very illuminating and have their lessons for the future.

V. K. N. MENON
Director

*The Indian Institute of
Public Administration*
April 26, 1961

CONTENTS

<i>Foreword</i>	v
I. THE RIVER VALLEY AUTHORITY IN INDIA AND USA	i
II. THE DECISION TO BUILD	25
III. PARTICIPATION BY THE USERS	49
IV. ORGANIZATION FOR RIVER VALLEY DEVELOPMENT	65
V. THE RIVER VALLEYS AS PLANNING UNITS	87
<i>Index</i>	107

I

THE RIVER VALLEY AUTHORITY IN INDIA AND USA

WHAT I am undertaking in this lecture, as in the subsequent ones, is a comparative view of the administration of river valley developments. The comparison is between the American experience and the Indian. If there be any here who feel that a comparison of two nations so differently situated is risky, I can only agree. Indeed, I shall explain later in what directions the risks may lie. Even so, this is one of the least hazardous of subjects on which to compare the experience of differently situated countries because the problems of administration of river valley development grow partly out of the nature of river valleys and of the physical works which men know how to put in them to capture their resources. These are by no means the same in one valley as in another. But there is a common range of variation of the physical geography of river basins, so that our colleagues, the hydrologists, can speak of climate, storm paths, topography, surface and underground storage, etc. Thus they can place any particular river basin accurately and measurably in comparison to others throughout the world. And the engineers can, by making certain assumptions about economic factors, tell us what the yield of the basin can be in terms of hydro-electricity, irrigation, flood safety, navigation, water supply, and sewage removal. Only the aesthetic possibilities

of a stream so far completely defy an objective comparison.

It so happens that our two countries comprise a sufficient range of climate and topography so that we can find a good deal of common ground as to the physical and technological potential of our rivers. This being the case, it follows that developing their comparable rivers with comparable or roughly comparable dams, turbines, canals, transmission lines, embankments, and bed-training works poses certain very roughly comparable problems of public administration. A minimum list of problems suitable for the broadest international comparisons, would include :

1. Planning, construction and use of the control works take several years. How are funds and other scarce resources to be made available steadily until benefits appear?

2. Rivers present different problems in different years—floods and droughts being the extremes. Again, how to keep a steady plan?

3. Several professions and large numbers of labourers must join to develop the river. How is their work to be coordinated?

4. Building a dam, even a canal system, involves concentration of manpower under common direction or only a few directors. Utilization of electricity or irrigation water is always decided on by other authorities. In a mixed economy, the users are hundreds, even lakhs, of businesses, residents or cultivators. How is construction to be kept in phase with use? How are the costs of construction to be shared by and among users?

5. Boundaries of river basins are almost never boundaries of units of government. How is co-operation to be had between two states or nations? How is a large government to organize to develop a basin which is only part of its territory? How are the interests of basin residents to be represented by constituencies which are not the same?

But I am not addressing my comparisons to all these questions. For want of time and knowledge I have perforce selected the narrow aspects of them. The basis of the selection is this: What questions will soon become more pressing than they have been, and what light does American experience throw on the possible answers to those questions? I am interested in the *predictive power* of the comparison.

Aside from the question, "How does one know what issues will be coming to the fore?"—of which I will shortly say more—one defect of this selection is that it does not even try to present a fair picture of the accomplishments in either nation. For instance, I shall say nothing about the way in which India, a federal republic, has succeeded in reconciling the interests of adjoining states in the use of the waters of a common stream, and very little about the expertly designed administrative machinery by which projects are chosen for priority in your plans. Any nation would be proud of these administrative achievements. The truth is that you have in these respects skilfully avoided pitfalls that (as many of us political scientists see it) America has been trying in vain for fifty years to escape. I shall say nothing about the high level of intellectual interchange which has been going on

upon some of these very problems in the Irrigation and Power Seminars which have in the last four years become an annual tradition. We have professional meetings, governmental conferences and occasional citizen meetings. But we have no interprofessional, intergovernmental discussions which combine such willingness to identify defects with such a responsible attention to correcting them.

Many of you have taken part in those Seminars, or have followed them in print. I would feel presumptuous indeed to try to retrace the steps here which have been taken in terms of specific solutions to problems already manifest. As a teacher of the administration of river basin planning, I only wish I had access to such stimulating and practical literature concerning my own nation's projects. Most of all, it is boldly to open up new ways of looking at familiar problems that the comparison of two nations can be justified. The detailed solutions each nation must, of course, work out for itself.

I

To one who believes that India is underdeveloped and the United States is developed and that, therefore, India is trying to move in the direction of the United States, certain lines of thought become obvious at this point. What problems has the US encountered at various stages of her development analogous to those India is approaching, and how, by benefit of this hind-sight, can India avoid or solve them? To the rest of us, however, the approach cannot be so simple. If we believe India has what every other nation has

so far shown—a dynamism, a direction of her own—we must seek India's lines of future development within India's own experience. Only if we can arrive at some definition, however over-simplified and tentative it may be, of the determinants in Indian culture and institutions which will assimilate her future to that of America, as contrasted to those that will divert it, can we claim predictive power for an international comparison. But there is the rub. We would be able to list scores of such factors; but we would not be able to agree which are dying out and which are of rising force; and in any event we would be so uncertain which are decisive for the trend of river valley developments. All in all, we would be inclined to leave such heady speculation to Max Weber and Arnold Toynbee, were it not for one providential tool of analysis. It so happens that India, in developing her own rivers, deliberately took up almost intact (the alterations are easily discernible) a segment of American experience and transplanted it in India. The segment is, of course, the river valley authority, or river valley corporation as it is known here.

It so happens that in 1958 the TVA, or Tennessee Valley Authority, is 25 years old, while the DVC, or Damodar Valley Corporation, is only ten years old. Each offers a long and adequate record of methods and results, although the TVA has been much more intensively studied and appraised. What I propose to do is to take advantage of this quasi-experimental situation by ascertaining which experiences of DVC have been similar to TVA's, which have been different. These will be the most definite clues we can get as to the underlying trends in the two countries to

divergent or similar prospects for river development administration. The rationale of our inquiry might be formulated thus :

<i>(Physical and engineering potential</i>	(Legislative and administrative pattern of development, DVC : TVA)	(Cultural and institutional factors conditioning river valley development, India : USA)	(Observable experiences and results, DVC : TVA)
Damodar : X	X		
Tennessee)			

The first term is largely quantifiable; the second is a constant, modified only to the extent of the departure from the TVA act and formal administrative set-up in launching the DVC. If we find out the final term we can solve for the third. (Only the more enthusiastic devotees of model-building in the social sciences will need to be warned that the quantitative form of this equation is largely metaphorical. But it will help.)

The first thing that strikes one in the comparison is the extraordinary parallelism of results. Both agencies have about finished harnessing the respective rivers. DVC had less to do, engineering-wise, to control a smaller river, and it has yet to build the two deferred reservoirs which alone will control and utilize superfloods. But TVA, also, has left some flood protection tasks to other agencies. Certainly each of the rivers has been brought to a degree of regulation unapproached by other rivers in each country. In both cases, moreover, there is an unforeseen, unprecedented, and apparently limitless growth of demand for electri-

city. Peak demand on the DVC was 322 thousand kilowatts in 1953, 160 thousand in 1957. The continuing growth must now be met by building new thermal power stations. This is being done. The navigation channel is at a much maturer stage in the case of the Tennessee, but already one can say that both channels promise to be among the few economically successful waterways in this era of rail road transport. Finally, each development has had associated with it a varied and rapid industrial growth in the basin and power market area. How much this is due to the fortunate natural resource base in each case we cannot say; certainly the *combination* of flood-free river bank industrial sites, assured water supply, cheap and abundant electricity, and low-cost water transport has been a powerful stimulus quite common to the two cases.

Each development includes a major programme for which there is no genuine counterpart in the other. DVC has its irrigation project, about which more would be said later. TVA has its major chemical fertilizer plant and soil fertility programme which has all along been a great economic and political asset.

Considering the stimulus to industrial growth associated with both projects, and the crucial importance of industrialization to the original aims of both it is surprising to find a similar judgment accorded to each by the respective national administrations. TVA and DVC each encountered some six years after they had been chartered, national criticism serious enough to produce investigation of their organization and attainments. In both the cases the

investigations returned a generally favourable verdict. But at about that time, in each case, national government policy quietly solidified against the use of the regional corporation device in the development of other major river basins in each country. Both organizations later encountered another trouble : vacancies on their boards of directors were not immediately filled, or were filled with interim appointments. TVA and DVC were in this last stage subjected to much more direct *de facto* control by the national executive than had been contemplated by the authors of the original laws.

In the case of TVA, this was the result of the appointment to the Board of a retired officer of the US Corps of Army Engineers, who saw it as his duty to carry out the policy of his chief executive even where it might seem to conflict with the TVA Act, and by the control exercised by the US Bureau of the Budget over the agency's budget estimates, or demands for grants. This was an entirely constitutional exercise by the President of his responsibility for the policy of the executive branch, though President Eisenhower's policy of expanding private rather than public power capacity conflicted with the aim of the TVA law and earlier programme.

In the case of DVC there was no such policy difference. But actual autonomy was decisively reduced one year ago, partly through a minor amendment of the DVC Act, when the decision was made to limit the whole-time status of the members and the chairman of the Board of Directors of the Corporation.¹

¹ The Damodar Valley Corporation (Amendment) Act, 1957, No. 59 of 1957, 24 December, 1957.

There is thus a strengthened chain of command from the central ministry to the DVC hierarchy. The part-time members of the board are nominees of the state governments of Bihar and West Bengal. The independent initiative of the Corporation in policy making was thus reduced *vis-a-vis* the States as well as the Government of India.

An interesting comparison could be drawn in terms of the legislative struggle which led up to the constitution of TVA and DVC. It is one of their most significant common features. It is touched on in the next lecture.

The parallel experiences India and America have had with similar laws, as we have seen the picture so far, warrant the hope that in the process of trial and error, one country's trial can save the other's error. Now we come to the divergences.

II

Mr Lilienthal in his vivid accounts of his stewardship as member and then chairman of the TVA board, defined the agency's greatest lesson as "grass-roots administration".² What he meant was this. Development of a region's resources, even its water resources, requires a whole train of activities. TVA might have done them all with its own staff. Instead, it confined its own administrative job to damming and controlling the river, generating and transmitting the electricity, manufacturing the fertilizer, and suggesting the broader programmes of regional planning and industrial deve-

² David E. Lilienthal, *TVA—Democracy on the March* (Pocket Books Ed., 1945).

lopment. The actual distribution of electricity and fertilizer to the users, as well as the host of little developments (sewage treatment plants, riverside docks, reservoir composites, planting and protection of forests)—all these it provoked and facilitated local organizations to do.

Since "local organizations" and "public participation" are among the most abused phrases in English, let us look more closely at them. These bodies were formally chartered by state law, as rural electrification associations, city electricity boards, agricultural extension associations, or minor watershed development associations. Their control was entirely by their member-users. TVA made few requirements: in the case of electrification associations, for instance, only that they submit to audit, charge no more than the stipulated retail rate for electricity, and not divert their net revenues to any purpose other than their constituted one of distributing electricity. But these requirements were shrewdly designed to keep the local bodies true to their tasks while leaving them responsible to their members.

The fact is these bodies flourished. And with it, they exerted certain by-product effects on the underdeveloped public life of the Tennessee Valley states. Municipal and rural local administration, for instance, has been transformed from corrupt and complacent to honest and conscientious. Even state politics shows some impact, for one US Senator from Tennessee, a man deemed invincible because of his hold on the patronage power of federal appointments in his state, was retired by a young opponent who charged him, among many other things, with trying to get his hands

on TVA jobs for important political appointments.

The DVC case offers only the slightest parallel to all this. The parallel is closest in the distribution of electricity. DVC power has, with the exception of the Bihar Grid, and perhaps newer organizations I have not learned of, gone out through the old distributors, some public some private. The customer has not the sense, therefore, of organizing with his fellows to make use of the benefit of the river development. But power customers are, so far in India, the economically advantaged and alert. They know their interests are served by DVC's supply of abundant and cheap electricity, and they have made some claim that the expansion be not interrupted.

The golden opportunity lay in the irrigation command area. Here DVC could do what TVA could not—establish a link through the delivery of water to every agricultural village—to some lakhs of families. It could thus give them the prospect of doubling or trebling their incomes. And since irrigation, particularly *rabi* irrigation, requires the collaboration of land-owners and cultivators along the same water course, it had thus the opportunity to enlist them into organizations for their economic advantage as well as for the fulfilment of the DVC's task of river development.

When I was in the Damodar Valley five years back I sampled the information and attitudes of cultivators in five representative villages. They were, of course, uninformed about the activities of DVC, except as canals had been surveyed in their vicinity, and they knew nothing of the expensive storage reservoirs on which the stability but also the cost of their irrigation water would depend. The cost was to be Rs. 10 and 15 per

acre, higher than the old non-perennial supply. They knew nothing of the changes in cropping, in relations between cultivator and landowner, between adjoining owners, or the whole train of agricultural adjustments which intensive irrigation requires. No DVC policy-maker was concerned about this. Indian cultivators could not be expected to be interested in irrigation before the water was actually available. I wondered about this at the time since I found political workers had already been to one village suggesting to the potential irrigators that DVC water rates would be exorbitant and that by concerting not to use the water they could compel a reduction of the rates.

I have not revisited the ayacut. For the sequel I draw on a report by competent Indian observers.³ In 1956, when the canal system was ready to supply water to a lakh of acres, contracts were signed covering one-fifth of that amount. But in fact only 12,000 acres, not 20,000, could be watered because of cuts and breaches in the canals. In 1957-58, the attempt to charge for the water was given up: 75,000 acres were watered free on this basis. Now the hope is that the Government of West Bengal will pass and enforce a law compelling payment of irrigation charges on all the land served by the canal system.

Now the TVA Act does not specify for the governments of the valley states any powers in the distribution of electricity, or in the agricultural programme. Certainly TVA had legal authority to deal directly with individual consumers on these matters, had it chosen

³ Hari Singh and S.B. Lal, "Utilization of Irrigation Potential in DVC", in Government of India, Ministry of Irrigation and Power, *Fourth Engineers' Seminar*, Srinagar, 1958.

to do so. The DVC Act also does not make it explicit just where the Corporation's power gives way to the states in the work of distribution, but it certainly reserves a sphere for the states :

... the Provincial Government may take over the maintenance and operation of any such canal and distributary The Corporation may, after consultation with the Provincial Government concerned, determine and levy rates for the bulk supply of water to that Government for irrigation The Corporation may sell electrical energy to any consumer in the Damodar Valley but no sale shall, except with the permission of the Provincial Government concerned, be made to any consumer requiring supply at a pressure of less than 30,000 volts.⁴

My informants conclude that effective steps have not been taken by the West Bengal Government for the utilization of the irrigation water. Here is a case in which the administrative theory Mr Lilienthal cited as the chief lesson of TVA was written into the Indian law : administration of the final utilization not by the national but by the state government. But the outcome in relationship with the public was as different as it could be.

Aside from the effects of this difference upon the economic justification of the project, and upon the actual production of food, I believe that it is one of the two reasons for the very different outcome of the moves made in both the US and India to narrow the policy-making discretion of the corporation. For

⁴ Act XIV of 1948, 27 March 1948, Secs. 13, 14 and 18.

those moves in the US encountered the informed and unanimous resistance of the delegation from the valley constituencies in the national legislature. The TVA had, as a by-product of its evocation of these local user associations and local government units, created a powerful political support for its own continued existence, and for the continuation of its policies. Since the pressure groups that government agencies sometimes spawn in the US to defend them politically are among the chief obstacles to the discovery of the general public interest, I want to be very clear about the nature of these supporting groups. They were groups, first, that had work to do and the burdens of repayment to bear; they were not mere claimants for government *largesse*. This made their political demands somewhat public-minded. Secondly, they were duly constituted by state law and thus required to be accountable to their members. With certain exceptions,⁵ they justified Mr Lilienthal's assertion that far from being parochial in their interests, they were showing a way, in their region, better to realize the otherwise confused interests of the nation as a whole.

Like Dean Paul Appleby, I do not believe that the word *autonomy*, in its literal sense of independence, can be applied to any agency of a democratic government. The public safeguard in the case of the valley corporation lies not merely in the prudence and restraint of those who steer its course, but in the existence of alert external critics of the corporation. To the extent that the national legislature and executive

⁵ These are fully explained (in my judgment overstressed) in Philip Selznick, *TVA and the Grass Roots* (University of California Press, 1949).

agree to withhold some of their more intimate controls over the river valley corporation, other public watchdogs must be relied on. In the case of TVA, the watchdogs were the *valley publics*, informed, organized, and alert. There are perhaps some such critics to take DVC to task if it falls short in delivering its electricity, but not in its larger tasks of irrigation and general regional development. And it was perhaps, therefore, in the logic of democratic theory as much as of political reality when its sphere of policy latitude was curtailed last year. But it was a remarkable departure from the American experience, one that certainly calls for our explanation.

III

Developing a river valley calls for many kinds of skills and professions. Getting the dams themselves built offers scope for the specialization of work. It was a hallmark of TVA and of DVC that they made use of new engineering specialties—the planning engineer, the construction plant engineer, the cost engineer—which have since become familiar to both countries. There are other necessary activities far beyond the scope of engineering—buying lands, resettling people from the reservoirs, estimating power requirements and calculating rates, controlling the malaria which reservoirs and canals may introduce. Traditionally in both countries the dam builders had depended on totally unconnected organization of the government to get these ancillary jobs done; in consequence they were often done late or as a routine. TVA and DVC organizations permitted these tasks to

be done by specially qualified men in the corporation's employ, and thus responsible to the same board of directors that controlled the building of the dams.

Specialization of labour was carried one step further. Dam building is, like commanding a military offensive, an exercise in fitting parts into a whole. It is much less predictable than it sounds. The parts that have to be assembled—reinforcing steel, girders, sluice gates, even stone and above all earth—are not, as you would suppose, uniform and standard. The means by which the assembly is done—the shovels, dumpers, compressors, air hoses, hoists, mixing plants, and especially the men and women—have their own vagaries. The dam building engineer has to be able at once to readjust the combination, to improvise a substitute for the failure, to get the process going again. And, entirely aside from that, there is the river itself, never an entirely known quantity, which may exceed all previous flood heights just when he gets his coffer-dam in place.

All this is ample justification for giving the construction engineer unified command over the assembly process. But at the same time each of the phases of the assembly—the purchase of the material, the keeping of the accounts and making of payments, the hiring of the men, the modification of the designs to fit the newly discovered rift in the foundation—is itself a professional speciality in which there are men more skilled than the construction engineer, and in which there are also certain public policies to be maintained—for instance, accepting the lowest tender, keeping auditable records of spending, and preferring

no one on account of caste. In the past these policies were put into the form of rules which the construction engineer had to follow, and the rules were enforced by somebody of the proper profession who did not work for the dam building agency—the Director-General, Supplies and Disposals or the Union Public Service Commission or the Finance Ministry. But chief engineers rightly protested that you could not build big dams that way, and so the controls were, after a great deal of time-consuming argument, broadly relaxed or suspended. Thus the construction engineer could get the man he needed by temporary appointment, or let out the work to contract if he could not get the equipment he needed in time through central purchasing.

TVA and DVC demonstrated a way to assure that personnel, purchasing, and accounting officers preserve the substance of the policies of economy and fair play and, at the same time help, not hinder the completion of the dam. The way is simply to hire sound experts in these various services within the corporation itself, to give them clear definitions of the policies they are to follow, and to tell the engineer that he is to use their procedure unless he gets an exception from the board itself, which makes the policies. The key is that the accountant and the personnel man now feel that they will be judged on getting the dam built, as well as on getting it built honestly. TVA and DVC are the only organizations where one hears construction engineers speak of "our" accounting system, or "our" plans for hiring, or "our" purchasing officer. Construction men were relieved to get help in the house-keeping phases of their jobs, so they could devote

their energies to the work in the river. One result was a gain in the actual, as contrasted to the paper, observance of policies of fair play and economy. That is true *staff work*.

Did the corporation's methods of management get the dams built on time, and for the estimated cost? That of course is the final test. TVA passed; DVC frequently has not. A good many explanations have been offered. One is that TVA, coming into existence in the midst of the American depression, had its pick of the nation's top engineers, who were then unemployed. That has some relevance. But I think TVA would have turned in a good record even had it come into existence in a time of full employment.

DVC's failure to get the top engineers it needed has deeper significance. Starting without an engineering cadre, DVC had two choices. First, it might build the dams itself by recruiting a complete engineering complement, headed by a chief engineer who could direct large-scale construction work. This it tried and failed to do. It failed, at bottom, for two reasons. An Indian engineer who might have met the requirement was not interested in working directly under a board of directors headed by a civilian; he thought that might interfere in his daily administration. Foreign candidates who were approached wanted high salaries, and the Corporation was not willing to make an aggressive enough demand on a reluctant Central government to meet their terms.⁶ Or DVC might build through large general contractors, who would boss the day-to-day

⁶ The difficulties of getting a chief engineer were discussed in Government of India, *Damodar Valley Corporation (Rau) Committee of Enquiry Report* (New Delhi, 1953).

construction operations with their own engineers. It later on got some of the finest engineers to supervise contractors, and to plan constructions. It let first big dam to a general contractor. When he had the usual troubles and costs of getting started in a job bigger than he was set up for, DVC was attacked for wastefulness and the contractor was accused of making a profit. Again, lacking support for a firm policy, the Corporation changed course. It tried to build its own dams. But unlike the other central construction projects, it has not been able to pull itself up to its estimates of completion dates of its larger dams.

Now it is very significant that this shortcoming of management (unlike the shortcoming of DVC on the side of relationships with the public) was sensed by certain officers and at least one member of the board of directors. In 1953, he resigned. Once again, it is a remarkable coincidence that the TVA board also came to an unresolvable conflict, and Dr Arthur E. Morgan was removed from it. But the sequel is completely different in the two countries. In TVA, the nature of the difference was spread before the public not only in the press, but in a searching Congressional enquiry in which both sides were examined and cross-examined to the utmost detail. DVC had its enquiry. But though it was thoroughly and expertly done by an officer of the executive, and though it dealt with the very managerial questions at issue, the criticisms of the resigning member were not made public, so that some sort of verdict would emerge as to the way the Corporation might succeed in building dams, or at least, what factors were limiting its success.

IV

At this point, we may summarize our conclusions. Despite remarkable similarities of statutes of organization structure, even of programme, DVC differed in its outcome from TVA. The difference was in two respects. With respect to the valley population who would have to utilize its products, DVC officers lacked a sense of identification, or importance, and of confidence. There was a gulf between them and the potential valley publics. Secondly, for the top management of the Corporation there was an inability to get the needed kind of engineering talent. This was remarkable in that DVC showed awareness of the value of specialized skills at lower levels. I cannot accept the ready explanation that DVC was headed by men less able than those who headed TVA. I knew them. The student of public administration who wishes to explain thoroughly these divergences must, inescapably, look to factors in the very cultural and institutional fabrics of the two countries.

That an experiment like a river valley corporation would be effected in its outcome by the distinctive traditions of the country, and that India's traditions differ vastly from America's must be considerations so obvious as to make one impatient at reaching them in so round about a way. The excuse for a deliberate, even, if pedantic, approach is to get it clear just *what* cultural differences affect river development administration, and what the future bearing of these factors may be.

One reason the top officers of DVC did not establish a partnership with its clients and users, it seems

obvious, was that there was a great cultural gap between the officers and the public. They were living in different centuries. Now this kind of cultural gap between the elite and the mass in the population is something the US never experienced. America was entirely peopled in the last 350 years by people who shared a general belief in equality and a personal desire to improve their economic position. That makes the Americans as like one another in basic goals and assumptions as they are unlike in national and even racial origin.

On the other hand the present differences between the college educated, urbanized, secular, science-oriented, perhaps Westernized government officer in India and the peasant is itself only the modern version of an old, we may almost say, characteristic distinction between the elite and the masses in India. While such a distinction is inevitable between the peasant masses and the court and merchant classes in any large peasant society, India's culture sanctified and solidified it by placing all high and widespread culture in the custody of a small group supposedly exclusive by birth and marriage. The impact of Europe, again in the last few centuries, was to evoke a new intelligentsia, English educated, but equally distinct from the masses.

Yet here we come to a remarkable sequel. What makes India different from other Asian cultures was not only the depth of the elitist culture, but the fact that *the very idea of a cultural elite was challenged directly in Indian, not Western, terms by Mahatma Gandhi.*

It is time, then, to distinguish the *residual* from the *emerging* elements in India's cultural context. Not only has the legitimacy of the elite, traditional as well as imperial, been

unravelling in the dual experiences Westernization and Independence, but two potent engines of equalization have been set in motion since Independence. These are (a) popular election and (b) the idea and effort of ending poverty. Clearly equality is *emergent*, and as clearly an elite is *residual*. Government officers could quite accurately assume that the peasantry was inert; shrewd political workers could assume the peasantry was ready to be organized—particularly when government introduced as radical an economic stimulus as canal irrigation, and the election campaign and legislative debate offered any enterprising critic a forum for championing the peasants' alleged cause.

Tracing the cultural factors underlying the DVC's crucial failure to get top engineers is more hazardous. But among other factors there must have been at work a basic difference of view regarding the specialization of labour. The engineer who knows he can direct a 20,000-man construction operation in the river, in face of the hazards of nature and the suppliers of spare parts, can appreciate the need of *policy* direction from a board over him. But *administrative* direction he sees as inevitable intruding in his competence. The ICS man, it is said by those who do not know the individual exceptions, has developed confidence that he can direct anything. But the cultural roots go deeper. All through the 19th century the ICS was in fact governing a population upon a moral basis of abstract justice which the population did not share. Combining the broadest local policy-making powers with control over his own establishment, the ICS man kept faithful custody of the honesty and integrity and principles of government. (It would have been a miracle,

had the subjects not already been accustomed to a cultural elite.)

Administering an Industrial Revolution calls for a pervasive morality even more than old administering the old rural district. It cannot be, however, of the same simplicity. You must be able, if you have specialization of labour, to trust a man doing a different job to do his own job well. There are various ways of attaining this. It can be done slowly, as Max Weber and R. H. Tawney show us, by a sweeping change of intellectual climate, not only the Protestant Reformation, but all the reinforcing movements contemporary to it. It can be done by political commissars. But since India will not partake of either, there may indeed be a kind of vacuum. To fill it some do perhaps look back nostalgically to the old Civil Service; some look to a proliferation of new services, including services of engineers. And some say, "No, it will have to be an inter-directed morality relating the man to his own job, and not any service at all".

Here we have the second emerging force in the future of river valley administration in India: the endless specialization of labour.

Thus we set the agenda for these lectures. In the next two we shall consider the impact on a fine tradition and mechanism of elite administration on the mobilization to political life of the remainder of the people. In the fourth lecture, we shall examine the competing claims of service and specially in the jobs of river development. In the last lecture, we shall combine the considerations of politics and administration in the particular focus of the river basin region or rather raise the question how far they can be combined there.

No one who is looking for a general testimonial for, or indictment of, the river valley corporation as such can have found it in this lecture. Our search was for something more elusive, but also more pervasive. The cultural determinants we were after condition, and will condition, any pattern of river development administration in India. Why then did they show up so dramatically in DVC? The reason is of course simple: because DVC was created on premises, albeit inarticulate premises, of a different kind, which India also shares, and which are emerging. The traditional forces may be invisible in traditional organization structures; in DVC they make or break the agency. But they are working everywhere in a tension of old and new. It is, I think, in India as in USA, a characteristic of the river valley corporation to show us better to ourselves.

II

THE DECISION TO BUILD

NINE years ago India's constitution makers introduced the most radical of all non-engineering changes into the administration of river valley projects when they subjected administration to the approval of all adults who care to vote. But the impact of universal suffrage does not show up at once. Administrators are let alone, for a time, doing what they had been accustomed to do; voters do not at once wield the powerful instrument of control placed in their hands. In India there is, we saw in the previous lecture, a special lag in the assumption of decisions by the masses of people—decisions which had been made exclusively by an “elite” group—educated, urbanized, westernized.

The elite, however, is residual. Equality of access to power is emerging. And this gives American experience a certain relevance to India's future.

It was in the administration of President Andrew Jackson, 1829–37, that the United States underwent the triumph full manhood suffrage in all the states. In this respect she stood then where India stands now. It is perhaps more than a coincidence that in 1824 the US Government, through the Secretary of War, conducted a general survey of possible river improvements throughout the nation. The broad-gauged plan was laid before the Congress. But that was the end of it for more than a hundred years. For in the meantime popular sovereignty ushered in

a tremendous growth of resource development by private enterprise rather than government (this does not seem likely in India), coupled with a localization of political interests (this seems to be taking place in India now). It was not until 84 years later that the US again took a broad national look at her water resources under the impetus of Theodore Roosevelt, and 110 years later that another Roosevelt established the National Resources Committee to give the country continuous advice on the needs and possibilities of our water resources. Congress declined to support Theodore Roosevelt's planning endeavour, and formally abolished the Franklin Roosevelt agency.

My conviction is that popular sovereignty holds hazards as well as opportunities for sound decisions to build river projects. The American experience is worth considering, however, not as a horrible example, but because it shows how popular sovereignty can, to a considerable extent, be reconciled with technical soundness and economic prudence, even though the hands of planners are rather completely tied. Indian Planners, with their greater authority and with the benefit of this experience, might very well bridge the wasteful interlude the US went through between 1824 and 1934.

India's Machinery for Decision

The solid reason for this optimism is that India has built up, in the short period of eight years, and mostly in the last five or six years, a most complete and appropriate set of government institutions for the decision of river undertakings. Public administration

authorities in America (and probably most Presidents, if they knew of these institutions) would regard them as a consummation devoutly to be wished. To make wise decisions of this nature, a federal democracy needs government machinery to do nine jobs :

1. Investigate the long-range potential of river basins to select schemes for detailed survey. For this job India has the Central Water and Power Commission. It is a further remarkable achievement that 12 States have, almost all within the past two years, set up water resource investigation circles in their Public Works Departments.

2. Prepare firm project plans. These should specify the cost, resource requirements, phasing, benefits, methods of construction and methods of utilization of the project. The Planning Commission was rightly concerned that less than half (178 of 364) of the projects submitted for inclusion in the Second Plan were proposed upon such accurate project plans. Some of the States had organizations adequate to plan a few projects, others had access to the planning service of the CWPC. The organizations were deluged with the tremendous volume of planning work required in the Second and Third Plans.

3. Review project plans to determine their technical soundness. This is exactly what the CWPC is well equipped to do and does in great volume.

4. Review project plans to determine their economic implications. The criteria include effects upon inflation-deflation, investment funds, cement,

steel and other scarce resources, alternative objects of investment such as fertilizer production or community projects, and value of the benefits—additional food production or electricity—produced. This review the Planning Commission is ideally suited to perform.

5. Make a revision of this economic assessment in the annual budget process. This has been the weakest link in the administrative review; yet the Planning Commission is now holding budget talks with the States to meet the need.

6. Reach agreement on the distribution of work between the Centre and the States, and between two or more states in the case of inter-state rivers. The Co-ordination Board of Ministers is of great help in the first, and Zonal Councils, and potentially the machinery set up in River Boards Act and the Inter-State Water Disputes Act, in the second situation. It was a very prudent move to establish these channels before the disputes became politically charged.

7. Reconcile the interests of legislators from affected constituencies with national economic and technical considerations, and to identify the issues of broad legislative policy involved. Meetings of the Minister for Irrigation and Power with the Parliamentary delegation concerned partly meets this need.

8. Equip the political parties to mobilize and reflect public opinion in an informed manner.

9. Get top executive policy made in this sector of national or of state affairs. The Minister for

Irrigation and Power, as a member of the council of ministers, does this job.

As to procedures for the administrative preparation of decisions, then, America can only learn from India. The decisions to sanction and the definition of the purpose, scope and agency of major river projects—e.g. Kosi barrage and embankments, Tungabhadra irrigation and power project—inevitably involve political considerations. I propose to show that even these considerations are not a mere jungle of irrational power, but can be partly reduced to coherence by the systematic mind of the engineer and the administrator.

Economic Evaluation

One way already well understood in both countries is economic appraisal by the cost-benefit analysis. I wish briefly to indicate its relation to the rather different line of approach I am suggesting.

Economic appraisal is particularly useful and necessary to sound decisions of irrigation and power projects because each project commitment locks up a large amount of money for a very long time—ten to perhaps a hundred years. It has the very useful aim, moreover, of facilitating the comparison of one possible river development with another, or even with entirely different development proposals.

Aside from this point, the cost and the benefits of project proposals have always been stated in rupees, or dollars. The question is therefore not whether to use economic appraisal, but whether to use it crude or refined. Economic thinking can refine such factors as the rate of interest on the investment, or the cal-

culatation of indirect benefits, or (combined with engineering thinking) the annual rate of depreciation.

In multiple-purpose projects, economic reasoning is essential to determine what part of the cost of the common dam and reservoir ought to be saddled upon the particular users of electricity or of irrigation, or the flood protected areas, since all are in a measure benefited from the same storage. This issue cannot with impunity be decided for administrative convenience, for the economic stakes (cheaper electricity or cheaper irrigation) are high, and will become political stakes if they are not reduced to economics and principles of policy. Here again, however, economic reasoning has to be coupled closely with engineering.

The Public Interest Factors

When all this has been done, however, appraisal of a project escapes the economic frame. Will the cultivators under a new outlet pipe take up new crops to make the planned use of the water? Should investment go into an already partly developed area where its fruitfulness is more certain, or into an area more primitive but more needy? What is the relative worth of electrification as against more food and better diets; as against more literacy? How important is it to keep people from losing their homes in a flood? These are issues too influential to be relegated to the proviso "other things being equal" of a single intellectual approach. But they are also too alive with human concern to be reduced to rupees. Such questions stay decided longer if they are frankly faced as questions of individual, group, and national *choice*.

To say that choice is to be made is not, however, to say that the problem escapes all logic. *What* choice is made is a subjective question. But *when* the issue is put, in what *form*, and to what *choosers*—all these are considerations which can be reduced to certain alternatives, which in interrelation, tend to have certain regular consequences. But this is, especially in India, a new field of systematic enquiry (though practising politicians have long since developed shrewd intuitions regarding these matters). We may therefore be interested in formulation of the regularities of these relationships which can be observed in the United States.

FACTORS AFFECTING PUBLIC INTEREST IN DECISIONS TO
BUILD RIVER PROJECTS : A TENTATIVE OUTLINE ¹

A. Within a drainage basin, *intensity* of public interest tends to vary directly with:

1. The physical and economic capacity of the drainage itself to serve the basin population at its established level of technology: Reliable water supply for domestic, industrial, or irrigation use, hydro-electric capacity, and a navigable waterway increase this capacity to the extent that they can be used and are needed. The basin's capacity is measured against the size of the drainage area.

¹ This formulation appeared in the author's article "Crises, Community, and Consent in Water Politics", *Law and Contemporary Problems* (Duke University School of Law) Summer, 1957, pp. 512-13. The whole symposium on "Water Resources" in this and the preceding volume fairly reflect current American concepts of the subjects of these lectures.

2. The flood damage inflicted: This is a product of the height, duration, and frequency of floods, and the value of human occupancy of the vulnerable flood-plain.

3. The conscious participation of the population in the control or utilization of the basin's water resources: Near the positive extreme would be watershed associations (most of whose farmer-members conduct water-conserving farm operations), irrigation districts (to the extent that their participation comprehends the storage and control of the water, as well as its use on farms), and hydro-electric distribution systems operated by members or municipalities (subject to the same proviso). Note the importance of reimbursement or financial support by beneficiaries as a creation of conscious participation.

B. Commonness of public interest concerning water resources development on the part of the population living in a drainage basin tends to vary directly with:

1. Intensity of public interest, as influenced by the factors in *A* above.

2. General social cohesion of the basin population: A basin centering on a city and roughly conterminous with its hinterland approximates the positive extreme.

3. Social cohesion between the communities or groups dislocated or burdened: The large storage reservoir dislocating communities far upstream of its flood control, navigation, irrigation, or

water supply benefits is an unfavourable case; so is diversion of water from a drainage in which it is inadequate to meet all needs.

4. The degree to which use of a water resource by one group or community facilitates use by another—*e.g.* construction of navigation facilities on a common waterway, or exploitation of hydro-electricity where unit costs decline with volume. By contrast, community of interest is inhibited where water uses are mutually exclusive—*e.g.* consumption of a scarce supply by irrigation or population of stream so as to render it unfit for other uses below.

C. The degree of interest in water resources development maintained by the *legislature* or representative organ of any unit of government tends to vary with:

1. Intensity and commonness of public interest, factors in *A* and *B* above.

2. The conformity of boundaries of the unit to the drainage area or portion of the basin system which is under control: A drainage all significant parts of which are in one state and which occupies much of the state's territory (*e.g.* the Central Valley of California) represents the positive extreme; a small inter-city or inter-country drainage in a state or an inter-state drainage in a federal nation approximates the negative extreme.

3. The relative importance of purposes served by the development among the purposes of the unit of government: This factor is, of course,

relative to the capacity of the drainage as in A above.

The Study of the Public Interest Factors

Technical tests have been applied to river projects in India for more than a century; the old economic tests are now being perfected. The nature of the public interest potential in such projects has only begun to be decisive; no doubt twenty years from now these factors will be studied and pondered as closely as are the other criteria today. The above formulation is a sample of the way in which regular factors shaping public interest can be stated. But actual use of these concepts to predict whether there will be a durable or dominant public interest in a project proposal will become possible only after this formulation has been refined; and then only as a set of mental tools to help lay hold of, and interpret, the large body of facts which must be collected about the public interests of any particular basin.

What I am presenting is not a finished yard-stick, but a challenge to begin studying this aspect of project decisions in the same exhaustive way, theoretically and in practical use, that has made it possible for engineers with a fair degree of accuracy to predict river discharges, or economists to predict annual costs. In our sector, certainly, the number of preparatory studies required is greater. It is high time that both our countries tooled up intellectually for this kind of analysis.

It may be of interest to know that even the crude formulation just presented has been drawn directly

from eleven case studies (most of book length) of decisions to develop American rivers: These were the lower Mississippi, Columbia, Connecticut, Central Valley of California, Lower Colorado of Texas, Missouri, Tennessee, Miami and Colorado (Boulder Dam). What might, so far a little ambitiously, be called a political science of water resource decisions has in the last ten years been emerging in America.

Why Has Public Interest Become Critical?

Most intelligent observers of public affairs in India are concerned that political considerations intrude deeply into what used to be technical and economic decisions. To attribute the intrusions to the rise of the electorate alone, however, is to miss much of the point. The proof is that such considerations have appreciably gained force in the US also, within the last twenty years, though America has been a "democratic Republic" six or seven times that long. Actually, as a quick application of our outline of factors will suggest, there are reasons inherent in the changed character of the projects themselves :

1. The new technical feats possible to modern engineering (high dams, dams on poor foundations, long-distance transmission of electricity) give us many more feasible projects from which choice must somehow be made.

2. But all technology is similarly expanding, and new concepts of welfare add many alternative projects (schools, roads, factories, soil fertility, etc.) to the agenda of governmental choice.

3. In order to derive returns which can be ploughed back to further this accelerating development we now demand that the irrigation water and electricity produced by our projects be put to productive use as soon as it is available, not twenty years later. This is all the more necessary because the new engineering works are costly and so lock up vast sums of money until returns come. We can no longer wait for the mere economic interest of the peasant and businessman to initiate use; it, too, becomes a challenge to political leadership.

4. One of the new engineering possibilities has of itself revolutionized the political significance of projects. This is the multiple purpose storage reservoir. It dates only from Krishnarajasagar on the Cauvery (completed in 1924). Yet in the decade opened with the completion of Hoover Dam, the US built ten more large multiple purpose reservoirs: Norris, Fontana, Shasta, Friant, Bonneville, Grand Coulee, Fort Peck, Tygart, Denison and Marshall Ford. Since independence, India has built or begun Tungabhadra, Bhadra, Hirakud, Maithon, Panchet Hill, Mayurakshi, Rihand, Koyna, Bhakra, Gandhisagar and Nagarjunasagar.

Two new public interest problems of these great reservoirs grow out of the fact that the storage is located at a distance, up to several hundred miles, above the ayacut or flood protected lands, while the market area for electricity may be in a different direction. One problem is that the dislocation caused by the reservoir is to an area, often to a state, quite different from that which enjoys these benefits.

Another is that somewhat different people enjoy each kind of benefit (they are never the same as the whole population of the drainage area), and yet their interests must be reconciled in order to operate and pay for the projects.

5. This problem is heightened when an entire major river is taken up for development not by one great storage reservoir, but several. Since all will not be built at once, there is the severe political problem of phasing. Suppose some of the storage required to control the worst possible flood is reserved for the second phase (this is the actual situation in the Damodar Valley), how will such a flood be explained to the victims if it occurs before the second phase is reached?

These five trends are implicit in the kind of projects being decided upon by all nations capable of large-scale hydraulic works. Democratization in India merely adds force to them. In deciding on river projects the element of public interest is there, must be there, and will increasingly be there. Since it can no longer be thought of as an aberration from the proper criteria—technical, administrative and economic—it is time we confronted it candidly under its proper name, *political*.

Of course, as these five trends show, the factual or technical considerations, far from receding, have themselves gained greatly in importance and complexity. Integrating, sometimes reconciling, the political considerations with them is a problem that does not solve itself, even in a country so admirably organized in its top governmental structure to do the job.

Why Public Interest Is Merely Latent?

At once, however, we encounter an anomaly. The political considerations, so potent in both countries, are still to be frankly faced in India, while in the US they have from general neglect been allowed to take parochial forms. The truth is that neither in India nor in America is there a ready-made national interest in river valley projects. The interest is latent. If it exerts itself strongly, it is because it has somehow been called into life. The reasons for this in the two countries are, however, entirely different.

In the US we are not much interested, all 175 millions of us, in river valley projects for the reason that we have become concerned with other things, things more removed from nature. When Abraham Lincoln grew up, his trip to New Orleans in which he got his emotional revulsion toward slavery was made by river. Twenty years after his death, Mark Twain was capturing the imagination of the continent with his stories of life on the Mississippi. Nowadays our family concerns are with unemployment and promotion in our work, health, education of our children. Our most general public concern is with war and peace. Not one of our public opinion polls for the five years, 1947-51, revealed any expression of public opinion on matters of water resources as such, for instance, in response to such questions as "In the coming Congressional election, what do you think will be the main problem that will be discussed?" I suppose that this is a perfectly normal shift of interest as a nation gets urbanized, and its economy elaborated, and its involvement in world affairs intense.

India's population, taken as a whole, probably would give rivers a higher priority. But the gigantic process of giving expression to India's population has just begun. Already we have some evidence to think that public interest will be aroused upon other issues more immediate and general, perhaps more personal than river developments: primary schools, for instance, or third class railway accommodations.

Now if we accept it as a common fact that public interest in river valley development is not mobilized, and at the same time that there are inevitable political questions involved in the decision to build river projects, then our attention must go to the ways in which this latent interest may be brought to life and consciousness. The effort to understand the whole outline of generalizations about public interest in river development will have been worthwhile if it can make clear that there are two ways to mobilize public opinion regarding river valley projects. They arise from the two types of consequences which a water drainage may have for the people in it. One type has to be foreseen and planned for; it requires work not only of engineering but the investment by thousands of people and their organization along economic lines. It can materialize, in short, only upon deliberate decisions of the people. Here follow such consequences as electrification, irrigation, navigation, and the conservation of soil. (Turning back to our generalizations, these are the joint products of Factors A1 and A3) We will call these the *participative potential*.

But a river may also affect people, and drastically, without their intent—indeed because of their lack of

fore-knowledge. The most clear-cut illustration is a river's power to inflict flood damage (Factor A2). We will call this class the *crisis potential*.

It is important for those who draw up project proposals to be aware that they have a limited degree of choice as to whether their proposal presents to people the participative or crisis potentials. For instance, flood embankment draw support from the fear of crisis alone; but to a degree on many rivers, the same protection may be had by storage which presents the participative potential of hydro-electricity, and possibly irrigation as well. The alternative may be there, moreover, even without change of the engineering features of the proposal. India has been finding in the last five years that a failure of the monsoon, a crisis, greatly speeds up utilization of irrigation water in regions of adequate average rainfall. But India is also trying to enlist the cultivators' participation without waiting for a crisis—of this more would be said in the next lecture. Finally, participative measures may be alternative to costly or even unfeasible engineering works, as the legal prohibition of erection of buildings in the flood-plain may be the only economically feasible method of flood damage control.

The existence of these alternatives in the way a project appeals to the local inhabitants makes it possible for us to state the first corollary from our outline of factors: *Considering only the populations which may be directly affected by the river and its improvement, and assuming that their interest in it is latent, that interest may be evoked either by enlisting their participation (Factor A3) or in their fleeting reactions to crises (A2).*

Though getting the immediately affected people to

take a larger part in both the decisions to build projects and in using them and paying for them is an urgent challenge before your country as well as my own, the fact remains that the big complex projects of these days cannot be paid for by the beneficiaries, at least straightway. Leaving aside other reasons, that means they must come up on the agenda of some government which possesses the power to levy general taxes: the states or the national government. Taking account of the lack of conformity of basin boundaries to state and national boundaries, that introduces an inescapable question: How is the general legislature (and even more difficult, the broader processes of party canvassing and election) to be interested in a project which covers only part of the state or nation, respectively? This leads us to the second corollary: *Considering the legislative and political processes of the whole state or nation, interest may be evoked in a river valley project either by identifying its programme aims with the important programme aims; of the government and the parties (Factor C₃), or in momentary public concern over crises which claim general attention.*

Why Crises Tend to Capture Public Interest?

There are a number of reasons why a preoccupied or latent public opinion focuses on river possibilities in moments of crisis. Droughts are, in a hard-pressed agricultural economy such as India's, the worst of all natural calamities. Floods are, in a technologically complicated nation, by far the most episodic, the most widely uneven, of crises. This can be seen at a glance if we compare the annual variation in flood losses

with the annual variation in losses from fire. In the United States, fire caused 2.7 times as much damage over the whole of the last 25 years. But whereas the *annual* loss from fire in the worst year was only three times that of the best (730 million as compared to 235 million) flood losses in any one year varied from a low of 3 million dollars to a high of 1,029 million.

It will be interesting to know that the elaboration of the means of getting and spreading news *via* press, radio and television only enhances the impact of floods on public opinion. Why is this so? Experts in the mass media of communication would have to tell us. But it is obvious that a flood crest (unlike a fire or storm) gives the newspaper correspondents, and even the television cameramen time to get there to cover it first-hand; that it is a most awesome spectacle; and that it puts on dramatic trial the morale and leadership of whole cities and districts.

Certainly it is true, and national boundaries make no difference as to this point, that whole populations are stirred emotionally by the knowledge that some among their number have lost their homes, crops and possessions. A single photograph of a miserable family taking shelter in a tree or on a floating roof will move people at large more than anything else a river can do. One American member of Congress made a casual comment which tells the story. Referring to alternative plans for the Connecticut River, one stressing electric power, another merely flood storage, he said: "The power question does not grip them emotionally. Power does not leave them wet and cold. Floods do."²

² The remark was made in 1937. William E. Leuchtenburg, *Flood Control Politics, The Connecticut River Valley Problem* (1953), p. 11.6

When the hearts of millions of people go out to flood sufferers, they call on their elected representatives to do something. One response may be simply to sanction single-purpose flood protection works which had not been given priority in the long-range plan. This is exactly what happened in India, toward the end of the First Five Year Plan. As the Government's sober *Review of the First Five Year Plan* puts it :

When the first five year plan was drawn up, schemes directed towards flood control were dealt with broadly as part of the irrigation programme. The floods of 1954 and 1955, which caused damage in several States, led to the building up of organisations for undertaking flood control programmes. . . . During the last two years of the plan the total expenditure on flood control works which were specially approved was of the order of Rs. 10.8 crores.³

One problem involved is, of course, that good project plans take many months to prepare, and plans sanctioned for crisis purposes may necessarily be hasty ones. A more serious problem is that flood protection can sometimes best be done by multiple-purpose storage. An emergency flood plan may resort uneconomically to single-purpose local embankments, or it may overlook reservoir sites or uses which would combine flood control with greater irrigation or power benefits.

Still more costly, in the long run, is the possibility that a nation bent on doing something quickly about floods may alter its basic water development policies

³ *Review of the First Five Year Plan*, p. 164.

in ways that deny it full utilization or a fair sharing of burdens for years to come. Precisely this last has occurred in the US. It is possible to correlate quite closely the major departures in national water development policy with the incidence of catastrophic floods, and to show that many of the departures were themselves ephemeral or even without practical result, like the national flood insurance legislation enacted after the billion-dollar floods of 1951 and 1952.⁴

Legislation Without National Public Interest

It is possible to have a national legislature take up the sanctioning of river projects without any kind of general public interest—whether interest in the broad benefits of the project in terms of food production or industrialization, or interest generated momentarily by flood or drought. If the legislature does so, and if political forces are alive in the constituencies, then it is possible that the legislature will generate a majority on behalf of the building of the project by a practice which is familiar in the US under the name of *logrolling*. In logrolling, legislator A says to legislator B: "I will vote to sanction the dam in your constituency if you will vote for my flood embankments." Note that this practice is different from (in a sense a perversion of) the general process of compromise, without which a democracy cannot make laws. Compromise means the legislator's sacrifice of his lesser interest in order to gain a majority for a greater. But logrolling is an acceptance of matters in which he is not interested at all in order to gain a majority for

⁴ See the chart in the author's article cited above, at p. 516.

an interest which is confined to him and his constituency. The difference is not in the give and take involved; it is in the generality, as against the parochial limits, of the concern with what is given and taken.

Now logrolling has not made its appearance in the Indian Parliament for several reasons. One is that a strong executive decides what measures will be submitted; another that a strongly disciplined party with an overwhelming majority connects the executive with the political leadership of most of the local constituencies. But since more equal party competition might weaken these bulwarks, it may be worth reflecting that India's vulnerability to logrolling in the long-range future is much more like that of the US than that of the UK, for the stage is set for logrolling by a federal system in which the pressures on the individual legislator come more from his constituency and state than from nationwide interests. And India, with its great area-wise diversity (including, of course, a language diversity peculiar to India among all) countries and rudimentary national economic interests, combines a secure and centralized present leadership with a high degree of latent parochialism in political interests. We can perhaps foresee the kind of balancing of sectional interests that will come into the agenda of the national party and legislative politics when the dominant party is fighting for its continued supremacy in a series of linguistic states, if we study the way in which Bombay State⁵ (the only state which now confronts an analogous problem) even now has to balance the development of its northern and southern rivers.

⁵ Bifurcated into two States—Maharashtra and Gujarat on May 1, 1960.

Since Indian national leaders, no more than American, would like to see this kind of balancing accomplished by logrolling, it may be interesting to note that in the US logrolling has for at least 70 years been confined to a particular kind of question put before the legislature : the "Rivers and Harbours Bill".⁶ This is a long listing of projects, big and small, for sanction alone. Logrolling cannot occur when major projects are brought up in individual bills. It does not occur even in the US when the question is of public purposes such as public development of electric power, public support of flood control in small watersheds, or methods of developing irrigation in semi-arid lands. Without going into the more difficult question of how logrolling may be uprooted in the US, I think it is clear that logrolling need never take root in the Indian Parliament if the present strength of leadership is used to enlist the legislature in the decision to build river projects upon considerations that are important to the members *collectively*. Even the balancing of investment among sections may be taken up in terms of general national criteria.

Legislating the Decision to Build

It is in the logic of this analysis that Indian legislatures, state and national, will have more and more to say about the chartering of great river projects. Where there is room for the best informed men to differ as to

⁶ See the fascinating account, which could virtually be brought up to date by adding two zeros to the dollars involved, by the historian Albert Bushnell Hart, "Biography of a Rivers and Harbours Bill", in *American Historical Association Papers* (1888), p. 180.

what the people prefer, a democratic constitution refers the issue to a legislature.

There is nothing in my analysis, though, to say that minor projects should be sanctioned by legislation. Indeed, they can scarcely interest all the members save *via* logrolling. Nor is there anything to say that the legislature can take a real interest in a long-range plan for a whole river basin, part of which will not be built for twenty years or more. The choice needs to be upon the most immediate phase that is hydrologically and economically separable. What I do have in mind is the scope of decision even now taken when a major irrigation, power and flood control project is included in the Five Year Plan.

With these provisos, there is no unavoidable reason why a legislative decision to build cannot conserve technical and economic standards. Even the wave of excitement accompanying a great flood or drought can energize the acceptance of a sound long-range plan, provided it was lying carefully drawn ahead of time, and took account of the full extremes of drought or of flood. Even the intense localization of interests in an irrigation or flood control scheme can be made conducive to responsible decisions by the general legislature, provided the legislature firmly puts on the affected populations the choice of using and paying for those benefits which are in fact localized. More of this would be said in the next lecture. But these are secondary considerations. The main thing is to lift the legislative debate on river projects to questions of national purpose or state purpose—the very kind of consideration which India's planning machinery makes it possible to visualize.

The great art of legislative leadership is to confront the house with an issue which comes home to the members, but leads their calculations into terms of the values and costs to the whole state or the whole nation. Being an art, such leadership defies prescription. We can, however, recognize (at least after some tests of time) the examples of the art. In America the Boulder (now Hoover) Dam Act and the TVA Act demonstrate that contesting interests, some highly localized, can be given their say in open debate, brought face to face with the facts of nature and economics, and durably reconciled with the interests of the nation as a whole. They show how demands born in the crisis of floods or of war can be channelled into decisions that stand the test of other years. In India, the DVC Act achieved as much. What we are seeking, in calling for this forthright study of the effects of politics on the decisions to build, is merely what has been attained in both countries on occasion. It is to harness the rising energies of peoples' interests to sound choices, as the rivers themselves are harnessed to their tasks.

III

PARTICIPATION BY THE USERS

THOUGH this subject is a broader one, I am going to deal entirely with the problem of the utilization of irrigation water in the great new river projects. For the electric power produced by them has been taken up and put to productive use so rapidly that characteristically new power shortages have followed the construction of each hydroelectric station.

The utilization of irrigation water brings our attention directly to the Indian peasant. He is being furnished by his government, State and Central, with canal systems watering great new tracts of land. In 1951, irrigation covered 51 million acres in India—that was one-fourth of all the world's irrigation. By 1961, it is planned to raise this to 87 million acres, and to more than double it by the end of the Third Plan.

It is obviously an enormous task to shift over 36 million acres in ten years from rain fed or inadequately irrigated cultivation to canal irrigation. The feature of this effort which strikes a foreigner as most remarkable is that in making the shift, the government will deal directly with each peasant under the canals. Assuming generously that the average irrigated holding will be five acres, that means that more than seven million peasants will, in ten years, be required to make the individual decision to use canal water. The government will collect the price of the water from seven million individuals. Would it be possible for

the peasants to organize themselves and stand responsible for part of this great job of changing cultivation?

The answer will at once be, "Indian peasants cannot co-operate to take on a business of this size". Since my own judgment would be of little use at this point, I call attention merely to the fact that Indian villagers *are* co-operating already in a very large business, that of loaning themselves money. There were, in 1955-56, 160,000 agricultural credit co-operatives, with 7.8 million members. But, we may say, the co-operative movement has been struggling to reach that point for 50 years; we have no time for such slow progress. Now, let us take the last five years. Agricultural credit co-operatives added three million members—that is just the rate at which new irrigators must be added. And lest anyone think the new societies are circumscribed to the money matters of each village, note that in the Second Plan they are expected to undertake 48 cotton gins, 35 sugar factories, 118 other processing plants, and 5,500 grain godowns.¹

We may wonder, however, whether even multiple-purpose co-operatives are quite as ambitious as the administrative, even governmental, task of introducing irrigation and collecting its cost. Are Indian peasants capable of governing an administrative job over-reaching their villages? On this point we have the carefully considered report on the future of the community projects by the Balvantray Mehta Study Team. An indirectly elected *Panchayat Samiti* will propose the Team, straightway to take control of the administration of agricultural development for each block of 75 to

¹ Figures from *Review of the First Five Year Plan* (1957), p.121 and *India 1958* pp. 290,293.

100 villages. That means providing improved seed and fertilizers, making taccavi loans, minor irrigation, local water supply, and the like.² That work is very like the local, agricultural side of canal irrigation.

Is it possible that there is something about irrigation, then, that unfits it for local co-operative or self-government control? It does involve, even in its local aspects, at least some crude knowledge of engineering. But this does not seem beyond the power of Indian peasants. In 1955-56 they managed 10 million acres of irrigation from tanks; even the major maintenance was not, in all states, done by government. They managed 17 million acres of well irrigation. And these minor irrigation systems are, of course, increasing as rapidly as the canal systems.

It is, of course, much more of a job for cultivators to take even a small collective part in introducing or paying for a canal system, because they must understand their relation to a system reaching several hundreds of miles. Are not the problems of social cohesion we referred to in the last lecture, of another order of difficulty? They are indeed. And this is what makes the present approach to the Indian peasant so remarkable. For under a democratic constitution, the approach assumes that he will accept the order from the state capital raising his accustomed water rate so as to pay for the distant storage reservoir and long canal. It assumes he will pay the betterment levy similarly imposed from afar.³

² *Report of the Team for the Study of Community Projects and National Extension Service* Vol. I, p.11 and Vol. III, Part I, pp.167-9.

³ "... there were practically no collections under betterment fees during the First Five Year Plan." *Review of the First Five Year Plan* (1957), p.167.

Signs of the peasant's reluctance to take on the new burdens are showing in several parts of the country. On the left bank of the Tungabhadra, cultivators did not dig the field channels connecting the government outlet pipe with their fields; the same thing happened at Hirakud in Sambalpur District. Significantly, the response of the government was to dig them for him, and add the cost to his bill—an increase of 5-10 per cent.⁴ In the Damodar ayacut, where the cultivators would not take water at the Rs. 10 and 15 rates, the government has been giving water free for two years. But it is counting on a bill which has been introduced into the West Bengal legislature making payment of the rates compulsory on all lands under the canals.⁵

Far from relieving the peasant of responsibilities, are not these moves asking too much of his statesmanship? I use that term because the peasants must be relied on to go to the polling places in 1962 and pass judgment on the members of the legislative assembly who vote these measures, and the ministers who are to enforce them. It is one of the features of democratic politics that opposition parties sometimes tell the peasants that such burdens are unnecessary.

The questions I am raising are not those of consent *versus* compulsion. Consent must be taken in any case under India's Constitution; the only question is whether the consent is to be at the polls, in the process of a political party contest for power, or by the poten-

⁴ A discussion of pros and cons of government construction of field channels occurred in the 1958 Fifth Irrigation and Power Seminar at Srinagar. A sub-committee of the Seminar recommended against the practice.

⁵ The same sub-committee favoured a compulsory *portion* of the water rate.

tial irrigators themselves in their localities, in economic terms. And compulsion there must be in any case to overcome the obstruction of a handful of ayacutdars; the only question is whether the decision to compel this handful is to be taken at the state capital and enforced by government, or taken by the assembled ayacutdars and enforced by state power duly delegated to them.

There are some tasks in establishing irrigation under a new canal which require collective action, yet they come very close to home in the rural village or group of villages. They include connecting the outlet pipe to each field, determining the distribution of water among the fields of the same village, and allocating the burden of repayment among those who are ready to use water, and those who are not yet. The question I am raising is whether the Indian cultivator is not ready to take on this part of the job through his own institutions and organizations provided it is carefully marked out for him. Or putting it in another way, whether he is not now being asked to be too wise, too unselfish, too foresighted and co-operative to select from among the politicians men who will go to the state capital and do these things resolutely at his expense.

II

The problem of enlisting the responsibility of the cultivator to make new irrigation work, and to make it pay, is one of the most difficult in the whole process of development. To say in 1958 that the cultivator is incapable of any organized and duly recognized

role is as premature as to have said in 1900 when the rural credit movement was launched on co-operative lines that the Indian villager could never run a bank. In neither case, at the stage we are considering, had the necessary conditions been created for his participation.

What are these conditions ?

1. *Provision of the necessary administrative services for agricultural side of irrigation:* For about five years, it has been understood by those in charge of ayacut development what these services are : early localization of the specific area to be irrigated, soil surveys, research and demonstration of the new cropping patterns, a special supply of seed, fertilizer, and agricultural credit, green manuring, perhaps new roads, markets, and colonization of new cultivators.⁶ What is new is that the national concern over unutilized irrigation water now makes it possible to get money sanctioned to provide these services.⁷ For the newest projects, they can be provided in time.

2. *Guidance in the organizational problems of establishing and maintaining local institutions for irrigation :* Irrigation involves not only an economic transformation, it involves totally new relations of one landholder with his neighbours. Where irrigation has been carried on for several generations under skilful and flexible guidance, new institutions have grown

⁶ See the comprehensive summary by M.G. Hiranandani, "Measures to Accelerate Utilization of Water for Irrigation", *Third Engineers' Seminar* (Srinagar, 1955), pp. 231-44.

⁷ Difficulties of getting appropriations to prepare the invisible agricultural prerequisites of irrigation as fast as the dramatic dams and canals were finished have been as great in the US. There is never anything as tangible as a construction schedule to keep up the pace of ayacut development.

up to conduct and regulate those relations. A fine example is the system of regulating turns at the ever-flowing channel, night and day, in the Punjab village. To develop such institutions in ten years for seven million peasants, some of them totally new to the business is a great claim on such guidance. Even more is the proposition that they might take on collective responsibilities for a segment of the canal larger than the village. Only seven years ago India might have despaired of finding workers accessible to the villagers to contribute this kind of guidance. Now a service, entirely suitable in its orientation, is within reach of every village: the village level workers or gram sevaks. To what extent has he been given this job to do?

I have sought the answer, first hand, in only four ayacut areas. In one, the extension staff, from the block level down, was concentrated on using irrigation to raise yields (chiefly through complete coverage of the block by green manuring). In three, the community project programme was exactly as it would have been, had the block not been located in an ayacut about to receive canal irrigation for the first time.⁸

3. *Assistance in the technique of irrigation itself:* How deeply should a field be cut in order to level it? How much water will produce the best yields, and how distributed over the season? How can waterlogging be avoided, cured?

In America, the US Bureau of Reclamation was not given the task of helping new irrigators solve such pro-

⁸ The Standing Committee of the National Development Council is aware of this need. See *Appraisal and Prospects of the Second Five Year Plan* (1958), p. 40.

blems. So real was the need, however, that another agency has been drawn into the provision of technical advice of this kind, worked out on the ground for each farm. It is the Soil Conservation Service. In 1956 the SCS suggested improved application of irrigation water covering 1.7 million acres. It gave agricultural engineering advice to 2,200 drainage and 813 group engineering enterprises covering 3 million acres. In America, as in India, there is room for the new profession of agricultural engineering, with specialization in irrigation.

4. *Scope for variation of administrative patterns and patterns of user participation as among the states and the regions within states* : The problems of utilizing irrigation water are different for each soil type, each rainfall zone, each market area, and each cultural tradition. Punjab, of course, differs from the Godavari and Krishna deltas, and both differ from the Deccan uplands, but there are crucial local differences in between.

The United States has a similar range of variation in irrigation requirements, but it has a single national agency and a single set of national laws regulating almost all government irrigation. However, in the US there are large projects, including canal projects, outside the Bureau of Reclamation framework. Some of them seem to fit the environments where irrigation is marginal. A fascinating illustration is the 168,000-acre Tri-Country Irrigation District in Central Nebraska. This is an area where farmers can grow wheat and even maize, in most years, from a 23-inch rainfall. They are unwilling to lock themselves into an obligation to pay for water every year, secured by a lien against their land, as the Bureau

of Reclamation must require. They built their own canals in the 1930's with a government loan. At the beginning of each irrigation season, each farmer may sign up for water on as many as 40-acre blocks (the farms here average 160 acres in size) as he cares to irrigate. For the remainder there is no water rate. In effect, each farm contains its own demonstration plot to test the *economic* value of irrigation; and the farmer can intensify cultivation at the pace his means permit.

India is fortunate, in adjusting to regional variations, that her irrigation programmes are state programmes, and not a single national one. It would be a retrograde step if, in the excellent forums now being provided by the Irrigation and Power Seminars and the National Development Council, the experience of each state were to be collated merely in search of a prescription that will cover the sub-continent.

5. *Enlisting the agricultural colleges in research and education*: Recently the Control Board of the Nagarjunasagar Project, preparatory to launching its development programme, sanctioned a two-part survey of the entire ayacut area. The agricultural portion is to be under the technical guidance of the Indian Council of Agricultural Research; a socio-economic survey is to be conducted by Andhra University. The survey is noteworthy in three respects: it is being done in time to give some guidance to development plans; it is concerned with the irrigators, and not merely with soil, water and crops; and it is being turned over partly to educational authorities. Only the Columbia Basin Joint Investigations in the US were so well planned.

Parenthetically, one might expect still further

information would be required in order to guide user participation in each ayacut. For instance, what is the area in which irrigators may most easily and most responsibly organize themselves to carry on irrigation? Is it the circle, firka, taluk, block, market area, or the group of villages in which daughters are customarily exchanged in marriage? Or is the village the only potential unit for participation? In one sense, the Reserve Bank now finds that the first fifty years of the agricultural credit co-operative effort were handicapped by a wrong assumption on this score. The Balvantray Mehta Study Team assumes the 75-100 village block is to be the unit. Is it not time to find out in each ayacut the area within which villagers are tending of themselves to organize?

Aside from this point, which is basic to proper guidance of the villagers in matters of organization, the purely technical and the agro-economic problems of introducing canal irrigation are extremely intricate. They cannot be solved once for all in a survey, nor can they be solved by technicians in one or two fields of knowledge. They require an all-round sustained application of science to a drastic and ongoing material and human change. They require the kind of approach that could be given by a complete agricultural college faculty.

Now I come to a point that seems, at first, unrelated. If we are candid, we must admit that the junior government officers who come in contact with the potential irrigators are themselves serious obstacles to enlisting the participation of the cultivators. This is partly because they do not know enough about irrigated farming, and partly because they are not

possessed with enough initiative to find out what the local situation is and work out a solution for it. I am speaking not only of the gram sevaks, but of the block-level officers, the staff of the research stations, the field staff of the agriculture departments, and the canal overseers. Partly this is a problem of administrative organization and supervision; initiative may not be respected and rewarded from above. But it is also a defect in the education of these men. Some were never trained to think; others were trained to think about the theories or laboratory experiments of others. Now criticism of the educational system along these lines is so current, and any educational system is so resistant to change, that there would be no point in broaching this subject were it not now almost miraculously within reach of solution. For there now exist a number of agricultural colleges in India (I have myself visited three) capable and desirous of giving a problem-solving type of education to future government staff, both at the degree and diploma levels. And agricultural education generally is undergoing a silent revolution in this direction, guided by the Indian Council of Agricultural Education. But training young men in this way requires that their professors put them to work on real life problems, what the medical colleges call "clinical material". New irrigation offers just such clinical material.

Probably the greatest single opportunity now within reach to gain long-run utilization of irrigation water is, therefore, to get an agricultural college in or near each ayacut area to take charge of the whole technical and human research job, and to use these research activities to train a generation of young men

with the skills, resourcefulness and enthusiasm that will come from solving the problems of a new agricultural technology and a new way of life. In some cases the colleges will have to be nurtured yet a few years, but in others all they need is for the government to give them the tasks of research and training, the funds that those tasks will in any event require, and then stay out of the way.

6. *Delegation of some of the legal powers of the state to groups of irrigators collectively:* As we noted, unanimity cannot be expected of a group of ayacutdars. They need the power to decide on behalf of all beneficiaries of a distributary or branch canal to take on the burden of repaying its cost. They need the power to dig field channels across the land of others. They may need the power to levy a tax on benefited lands. Such powers must be wielded according to legally stipulated procedures, requiring decision by some extraordinary majority.

7. *Participation as a test of project proposals:* The ability of local leadership to galvanize a group of cultivators into responsible collaboration cannot be defined, or engendered from without. In any country, it is largely where you find it. What the administrative authorities can do, after making other required facilities available, is to wait for such leadership to show itself, not undermining it in the early stages by taking over too much of the job on its own account, and then to give priority to those proposed projects where such leadership has aroused responsible collaboration. Recognizing spontaneous leadership requires administrative flexibility. India is equipped for this. The Planning Commission considers, for each Five

Year Plan, many more irrigation projects than can be included. At present, the selection is made on technical and economic grounds, and on such broad political choices as we discussed in the previous lecture. Participation may then arise at a chosen project, or it may not. Since the willingness of the cultivators to use and pay for the water now controls the accuracy of all the other estimates of the project's feasibility—technical, economic and even political—why not ascertain that willingness in advance, and select those otherwise feasible projects where it has in fact been aroused? For it can be tested reliably in terms of the organization of the potential cultivators into co-operatives or districts, and their collective decision to assume the legal obligation to pay.

Incidentally, should the Planning Commission apply such a test, more of the energies of political workers also might be drawn toward enlisting the interest of cultivators in projects, rather than interesting administrators and legislators in them.

III

It will seem to some of you that I have been talking in generalities about participation of irrigators in the work of preparing for, distributing, and paying for canal irrigation without making any specific proposal of the form for such participation. To this charge I plead guilty. It would be possible to hold up to you the patterns of the American irrigation district, the soil conservation district, the rural electrification association, or the watershed association as the solution to the problem. But that amounts to a derogation of my

main point. That is, that the manner in which Indian cultivators take up a larger part in utilizing irrigation water will have to grow out of the Indian countryside, in many respects the local countryside of each ayacut area. The whole job of digging out the facts which would guide us toward each solution, and of learning from the varied experiments in different parts of the country, lies ahead.

One interesting, entirely healthy manifestation of democracy in India is that the representatives of the voters and taxpayers are calling more and more vociferously for the productive use of all the nation's physical works. In some ways India is now choosing between the short range and the long range answers to this demand. One answer is for the governments to undertake whatever remains undone to get utilization. That is a quick-acting but short range response, not merely because it adds to the cost of a national plan which is already curtailed for want of funds, but also because it defers or removes from the cultivator the decision which he must eventually make—the decision to produce more by investing more of his work and credit.

An incidental result of the interest in utilization has been an instructive debate as to the size of the unused irrigation potential.⁹ Dr K.L. Rao argued recently that it was only 16 per cent—3.9 million acres being irrigated in 1956-57 out of 4.7 million added under major projects in the First Plan period. Mr B. S. Nag's figure was 37 per cent unutilized taking the potential at 7.5 million acres. Both defined the irrigation potential as the area for which there is water available at the outlet pipes: the engineering potential.

⁹ In the *Fifth Irrigation and Power Seminar*, (Srinagar 1958).

The question raised in this lecture is whether there is another irrigation potential in India. It might be called the potential of public participation. This is the area which could be supplied with water if the latent willingness of cultivators and landowners to invest in irrigation could be realized. What is India's potential of public participation? If it seems to be less than the engineering potential, is that because it has been left out of account in selecting as well as in developing the major projects? One can find some hints that it is very large: the pump sets going into the very areas where canals lie unused. Or the action of the landowners in that part of the Nagarjunasagar ayacut which has been postponed to the second phase. They organized themselves and said to the government, in effect: we, too, want irrigation. If you cannot include our lands in the Five Year Plan, we will bear the cost of the extension ourselves. Collect it from us as betterment levy. Give us the power to spread the obligation also upon those few among us who are not yet convinced.

Such evidences can only be fragmentary until the conditions have been created under which public participation will appear. One has to make his estimate now, as one had to estimate the potential of participation in co-operatives, in panchayats, certainly in general elections themselves, as the Balvantray Mehta Study Team put it, by "an act of faith". One has to estimate now lest the potential of public participation be pulled down in the short range effort to attain the engineering potential. One has to answer for himself the question about the river projects I wrote down several years ago:

Have the people, the millions, who used to petition and bless the rulers for good works, begun enjoying—and creating—works too vast, and too intimately serviceable, to be the work of any sovereign save themselves?

IV

ORGANIZATION FOR RIVER VALLEY DEVELOPMENT

I

It is about organizing *a service* for river valley development, only one aspect of the whole question or organizing for river valley development, that I wish to talk. The *Oxford Dictionary of the English Language* has something interesting to tell us about the origins of the term Civil Service. It tells us that the first use of this phrase in English occurred in the 1790's as applied to the non-military portion of the personnel of the British East India Company in this land. Since the very term Civil Service grew up in India, it is not at all unnatural, strictly speaking, that the concept of a service into which a young man is drawn at an early age and in which he covenants to spend the major part of his active life should be the first way one conceives of organizing a group of people to do a demanding task. I have not pursued the history of the Indian Service of Engineers but I did come across by accident the career of the man who built the first major canal in North India—Captain Cautley—the man whose work resulted in the establishment of the Thompson Engineering College, which later became this outstanding University whose Vice-Chancellor chairs our session to-night. Cautley was an officer of the Bengal

Engineers and therefore some at least of the early engineering work in India was itself organized as a military service. It was organized as military personnel is organized in any country by this kind of early recruitment, disciplined service and systematic promotion within the officer ranks.

I have laid some ground-work in my first lecture for suggesting that there may also be a still deeper reason why the concept of a life-time career service would be a perfectly natural outlook in Indian culture. This reason includes the fact that the British had to govern as strangers in India, administering a Government whose very ideals were not assumed or even understood by the mass of the population. It was natural that they should control very closely those who entered the Services, the attitudes they imbibed in training, and the standards which they followed in their work. From this viewpoint we can see why the Services should be insulated by the colonial power not only from the politics but from the life of the country. One might almost say in summarizing this body of Indian History that it has come about by a kind of geological inevitability that in India the only alternative to an occupation entered by birth has been a service entered for life.

This is not the only way to organize a large number of people to do the work of a high standard. In order to demonstrate the range of possibilities, and some of the consequences of adopting one or another of them, let me lay before you two contrasting types of engineering services in the United States. I am going to outline the TVA personnel system and that of the United States Army Corps of Engineers.

In the Tennessee Valley Authority, which in its twenty-five years has designed and built more than twenty dams and six very large thermal power stations, the head of the employment department was Mr George Slover, who was himself a civil engineer. He directed a group of employment officers all of whom were professional engineers of various specialties. These engineering employment officers recruited new engineering staff in two ways. One was to visit the better engineering colleges at the time of graduation and on the basis of their college grades and the testimony of their professors, select a few young men to enter the service at the junior level. This college recruitment produced some fine engineers, many of whom stayed in TVA employment for fifteen or twenty years. But by far the larger quantity of engineers, including those holding the topmost posts, were recruited in another way—they were drawn in mid-career from other employers. Initially, TVA had the advantage to be offering work during the economic depression of the 1930's, when unemployment was severe. But within a few years the employment officers and the heads of the design and construction division had earned the confidence of other large employers, engineering professional societies, and government engineering agencies, so that they advised the TVA who would be the best men to fill a particular specialized and possibly highly responsible vacancy. Even with this precise information about candidates, the employment officers did not tell the department head whom to appoint. They sent round to him, in fact as many names of candidates as clearly met the specific requirements of the position vacant.

That might be ten or twelve names, or as few as one or two.

The selection was made for a particular position. Much of the difference between the Tennessee Valley Authority system of staffing its engineer work and that of the Corps of Engineers rested upon the procedure by which this position was in fact defined. Each position in the TVA is formally and explicitly described in writing (ordinarily in a page and a half of close typing). There is a statement of the tasks that this engineer is expected to perform, the degree of supervision or independence he will have, and the qualifications that any one must have to do the work. This statement is originated by the supervisor of the position, discussed with the existing incumbent, and approved by the personnel department officer. It is the business of the personnel department to compare these position descriptions with the other and make sure that they add up to the total work of the design department or construction department and that the proper relative salary is attached to each.

It is probably no coincidence that having proved their capacity in this exacting work of comprehending the duties and responsibilities of each position in the organization, and its relation to the whole agency, the TVA Directors of Personnel became quite valued advisers to the vigorous administrators in the TVA and Mr Gordon Clapp, who was General Manager and later Chairman of the Board of Directors of TVA, was himself the first Personnel Director.

Within the service, the engineer appointee advances freely as rapidly as higher positions fall vacant, and his own abilities increase. But he is always thought of

by the employment officers as in competition with men who might be recruited from outside the agency. The employment officers will, in fact, send the names of outside candidates to the department head thinking of making a promotion, unless the candidate in line for the job within TVA has clearly met the higher requirements. How the current capabilities of a TVA engineer are assessed itself is an interesting procedure, but here it is only possible to say that his supervisor must make highly factual reports on his performance semi-annually, and discuss these with the employee before recording them with the Personnel Department.

Whether or not for the reason that an engineer is always a potential competitor for all jobs within his abilities in TVA an atmosphere was created in which some of the engineers considered themselves as always learning. This can be very clearly illustrated by one seminar which was conducted at the initiative of some of the design engineers themselves. The leader, Mr Calvin Davis, suggested that to gain insight into the inter-relation of the various considerations involved in planning multiple-purpose projects, they make detailed studies of the planning of river basin projects, other than the TVA. Some seminar participants even visited distant projects in the United States at their own expense, learning the lessons that could be had for their own improvement. Many of the engineers could be found, even men in their forties, in post-graduate courses at the University of Tennessee at night; and there was a general atmosphere of continual self-improvement in this service.

Certainly one other reason for this, though I do not think the main reason, was that access to the very top

positions of the agency were entirely open to the engineers. When I left United States, the General Manager of the TVA was himself an engineer—Mr Wagner. Indeed, one of the recent members of the Board of Directors—Mr Harry A. Curtis—was formerly a chemical engineer employed in the TVA.

The key features of this TVA system are two. While many young men enter the service at graduation and remain in it indefinitely, still more come in at the middle and even higher levels. The insider is not promoted to a job for which there is an outsider more precisely qualified. Secondly, while TVA engineers were continually enlarging their skills, it was always recognised that new and exacting jobs might arise for which only a man with training and experience unavailable in the agency would be completely fit. To take an obvious case, this happened on a large scale when TVA turned from building dams to building thermal power stations. The needs of the job, always possibly new needs, were the first consideration, and competition was open to all to meet those specific needs. I will call this approach to staffing an engineering organization the *open or position* system.

II

The United States Corps of Army Engineers operates with fundamentally, though not completely, different procedures. When we start with the current situation and trace a little bit of the history, you can observe good reasons for this difference. The typical officer of the Corps of Engineers of the United States Army

from the point of view of river development is a District or a Division Engineer. A Division would encompass a major river valley like Colorado or Lower Mississippi. The Division would include four or five Districts. A District might contain a tributary basin, or a segment of the main river, one to three hundred miles in length. The typical engineer in charge of such a District in the Corps of Engineers has a rank of a Colonel. His average length of service would be sixteen years, of which five years would have been spent in civil work, and the rest of the time on military engineering operations. I mention this, not because it is analogous to India's situation, but to show how complete is the emphasis on planning the career of the individual rather than meeting the needs of a particular job. It is a rule to post a District or Division Engineer to a particular river assignment for no more than three years. His tenure may in fact be ended in two. Rotation is considered essential for training the United States Army Engineer Officers.

The officer's command consists of only a handful of fellow officers of the Corps of Engineers plus an average of 220 non-officer (you would say Class II, III and IV) in the case of a division, 853 non-officer personnel in the case of a district. It is in the District where most of the design work is done, and where the contracts are supervised. The non-officer staff working under the Corps of Engineers will certainly include men who have a longer experience on the river in question than the officers of the Corps, and collectively they have a much wider range of the specialized fields of engineering. But remember that these subordinates cannot hope to rise to District or Division Engineer,

since those posts are reserved for a particular career service. It is the District or Division Engineer who constitutes a representative of the Corps and advocates his plans before the public, whether in a public meeting in the area or before a committee of the national legislature or Congress.

How is it that the United States Army Corps of Engineers has come to be organized in this fashion? In order to understand the history, you must go back to a period in the United States when political patronage was generally rampant. I am afraid, as I said in the previous lecture, that this encompasses the time between the administration of President Andrew Jackson beginning in 1829 and the passage of Civil Services Act in 1887—all of half a century. The United States Corps of Army Engineers then stood in United States as the only body of engineers working for the national government whose immunity from fiscal and political corruption was not in doubt. The Corps of Army Engineers, in those days though not entirely so now, was recruited from graduates of West Point National Military Academy. The boys who went there went at a very early age and they underwent at the National Academy a very strict code of discipline, both individually and also collectively. The honour of the Corps meant a very great deal to those young men.

You can readily see how, in one sector of American Government, the Army Corps of Engineers constituted a "steel frame" of honesty and fidelity during fifty years of shifting party patronage and graft. But in this century, too, when the Government as a whole

had been cleansed of those evils, the Army Corps of Engineers has been called on to do more and more river work. The Corps has a tradition that it will do any new task, anywhere in the world, honestly and quickly. This it maintains partly because its own officers are very intelligent and by virtue of their rotation in service, relatively versatile; and partly because a handful of officers direct many thousands of non-officer employees and contractors. Indeed, there are only 250 Corps of Engineers officers engaged in river works in the whole country. They command 20,000 non-officer employees including many engineers, and supervise scores of private contractors who perform the actual construction of dams, embankments, and river erosion control works.

The Corps demonstrates, it is evident, a different approach to personnel policy than TVA. The difference lies essentially in two points. Recruitment to the Corps comes regularly only at the bottom of the career ladder and at the start of a man's professional life. Even the meritorious civil engineer advising the Corps Officer cannot advance to his position. Secondly, rank, pay, promotion opportunities and precedence are attached to the man—the individual officer—and not to the work to be done.

There is the same care taken in promotion as in TVA. But the promotion board compares a man with his fellow Colonels or Lieutenant-Colonels as the case may be, never with outsiders, and always considering his all-round ability for all of the demands of the Corps, not any particular river development job to which he may be posted. That is why this system of

personnel administration may be called, not the *open or position* system, as in TVA but the *closed career or rank* system.

III

It is only fair to say that in the US authorities on public administration, as well as students of the subject including myself, have criticized the Corps of Engineers as a service of river development. But these criticisms are mostly on its relations to Congress, and for the sake of our present analysis we can assume, as do most legislators and common citizens in the US, that the Corps and the TVA are both successful in different ways. Do the different ways of organizing a service produce different results? I believe you can find that they do.

The first question is of the relative effectiveness of these two kinds of services in dealing with the problem of corruption. This is a problem that we have to reckon with—it is a problem that is with you. Assuming that there is a general tradition of corruption in the type of work government engineers are engaged in, which was true in the United States in the nineteenth century and in certain local governments is true today, the closed career may be the only way you can introduce an entirely new level of morality in this situation. It takes a man at a time when his morality must be selected. The TVA found plenty of people who are honest and employed only those who are honest; that would not have been possible in the Presidency of Andrew Jackson or Ulysses S. Grant a century ago.

If you develop them fully closed career system has great advantages toward incorruptibility in a corrupt

society. The young engineer is aware that in each moral decision he makes he is not deciding only whether he would risk his rating as an assistant engineer, he is deciding what his rating would be for life. For he does not count on transferring to another employer where the record he made as an assistant engineer can be forgotten. Secondly, morale of the entire service stands invisibly at his side when competition faces him. That is a real enough thing. And finally, of course, once you establish a tradition of integrity, it is possible for the career service itself to symbolize that through the years and to act as a kind of fly-wheel towards keeping a service honest even though new and more seductive forms of temptations may arise. This indeed was a great strength of the US Army Corps of Engineers because its moral tone had well been established by the time of Andrew Jackson and was carried forward during the remainder of that century.

I do not think any of these factors itself is absolutely crucial as between these two systems of organization. I think that a more important factor, which was crucially important to the Indian Civil Service itself, is the kind of individual training that was given to the man when he began his service. One cannot assume by following a closed career service that one can neglect the moral training of the recruit. I should like to know, I certainly do not know, whether it is one of the differences between some of the engineering services in this country and the ICS/IAS that the ICS/IAS regularly saddled senior officers with much heavier responsibilities for the close personal instruction of the junior at the time when the latter was just

taking up his service, than was the case in the engineering services.

The second item on which I would like to compare these two types of services is as to the respect paid them by the general public. Prestige is good, not for satisfaction of the incumbents of the service alone, though prestige powerfully stimulates morale. Still more is it valuable for purposes of recruitment. A nation wants to draw the very best to its service. A closed career service such as the US Army Corps of Engineers or US Foreign Service exerts a magnetic power on the young college graduates. I think, however, there are some other considerations here as well. One of the factors which determines the prestige of a particular service is the question whether its incumbents do in fact have access to most respected positions in the whole of Government. I think the United States like the TVA within its own sphere, is very fortunate in that it does not close any of its highest positions, except perhaps the judiciary, to members of the engineering profession. One of our central ministers—we call him Secretary of the Interior—has been a very fine electrical engineer—Mr Julius Krug. One of our Presidents—Mr Herbert Hoover—had been a mining engineer and certainly his national reputation grew partly from his great contribution to inland waterways and to the sanctioning of a great dam on the Colorado—one like Bhakra—named for him. This source of prestige for any government service, engineer or otherwise, comes from its eligibility to attain the supreme positions the nation has to offer, and has no direct connection with the question of a closed career service.

The engineering profession moreover offers oppor-

tunities for prestige which are available to very few vocations. That is because the big works of the engineers become visible. A man who has built a monumental dam, or a canal as large as many of nature's rivers, has carved out a place for himself in the minds of his people which is available to very few other public officials or administrators. The problem arises in the case of engineers who do less visible but equally vital work like the operation or maintenance of a great irrigation system, or, still more acutely, the proper utilization of thousands of tanks or wells or rural electrification schemes. They, too, should feel that they have some place in history.

IV

I come now to a criterion which is very difficult for me to talk about in ways that you understand but which seems to me to be very important in comparing these two kinds of organization. I refer to the kinds of responsibility which a top engineer has toward members of the public or representatives of the public. If an engineer is to produce results in terms of utilization of the products of his dams and canals—electricity or irrigation water—then he must be willing to challenge the potential consumer (whether individually or through districts or cooperatives as I suggested earlier) to take up that use, *and pay for it*, before they are all convinced that it is to their advantage. Of course, this means potential controversy, controversy that may even turn into political agitation. Will the river valley development service have the courage (or is it foolhardiness?) to risk such controversy?

There is a view here in India that servicemen have

the temerity to challenge habitual ways in direct proportion to their own immunity from reprisal. The case used to support this conclusion is the old ICS. But the ICS drew its courage from two sources: not only its immunity from political dismissal, but I think more basically, the absolute certainty, in its old spheres of revenue collection and law and order, *what the right aim of administration was*. To let the situation get out of hand was suicide. It is this certainty that is not available in the developmental spheres of government. Men equally wise and devoted to the constitution do in fact disagree on whether flood control (or irrigation or electricity) is a sound investment for the man who must pay—even if the project is in the Plan. Time will usually prove one right and the other wrong. The man who is wrong may be the government administrator. If so, the citizens of a democracy will ask that he be removed—that is the reasonable price of their continued confidence in the future developmental challenges from the government.

Appreciating this, men who are sensitive to the conventions of democracy and yet treasure the invulnerability of a closed career service tend to draw in the frontiers of their work to those minimal areas where, like the old ICS, they can be sure they are right. Within that area they are indomitable. The Corps of Engineers has never, so far as many critical investigations have been able to show, compromised its strictly technical engineering standards: never put too little cement in a dam, or built a spillway too narrow, or an earth-fill too lightly compacted.

But that is never the whole question a government must decide in building a modern project. It must

know whether the project will pay. To this, the closed career servants in the Corps cannot give an authoritative answer, for they decline to get involved in the controversial sphere of promoting utilization and collecting repayments. They have lately built some of America's greatest hydro-electric dams, and stored water for great million-acre irrigation projects. But they firmly decline responsibility for distributing or selling water or power. The Bureau of Reclamation nationally and the TVA in its own area—neither of which is a closed career service—take over the utilization responsibility.

No doubt part of the reason for this reluctance of the Corps is its military character—a problem you would not have with an all-India service of engineers. But part of the reluctance comes from two limitations inherent in any river development service organized on a closed career basis and confined to the engineering profession. The first limitation comes from the fact, that though utilization programmes require economic as much as engineering judgments, a service of engineers cannot incorporate men of primarily economic competence intimately or equally. It may, to be sure, employ men of other professions, as the US Corps of Engineers employs electric power market analysts and transportation economists, but it is most unlikely that their advice will effect policy decisions of such services with the same strength and clarity as engineering considerations do precisely because the direction and organization of the service itself is of a single profession, engineering, and not of the various professions required for the total job of river development. Engineers weaken their case for opening top secretarial and

ministerial jobs to engineers if they would close top river development jobs involving economic or industrial or agricultural considerations to administrators from those backgrounds.

The second limitation is that once questions reach beyond technical engineering considerations, it becomes possible for even the best administrative judgment to err, and a democracy must have a way of exerting sanctions upon all errors of judgment. How is this to be done in a closed career service? The answer will, I am sure, seem obvious: by requiring that the career officer take orders on all questions of policy directly, or through some intermediary, from a political executive who can be removed if the policy proves seriously mistaken. This is, indeed, the rationale of any answer, but it makes a vital difference, in practice, how close the politically responsible policy-maker is to the engineers, economists, and others who shape policy questions for him to decide. The closer he is, the more he will understand of the hard physical and economic facts which pose policy issues, and the more they will understand of the hard processes of opinion formation and the reconciliation of interests by which durable policy decisions have to be taken in democratic government. It is a basic limitation of a closed career service that it tends to cut off the careerist from ever becoming such a policy-maker, as it tends to deny the potential policy-maker the experience at an earlier stage of his career of professional work in the service. Paradoxically, it is only the understanding of the respective roles of the policy-maker and expert that comes from close contact and exchange of experience, that permits each role, in practice, to respect and not fore-

close, the other. For what the technical career man cannot realize, who has never been sensitized to the process of policy making, is that most of a complex policy decision in the field of river development is pre-ordained by the form in which the question is posed to the political head. It is, of course, equally true that sound technical decisions can only be made if the political head asks the right technical questions.

It is possible to illustrate this very forcefully if we turn from the phase of utilization to another phase of river development work which transcends technical engineering—project planning and authorization. I will deliberately present a case where a Corps of Engineers officer finally choose, taking a political risk upon himself quite uncharacteristic of his career service, to put up the right political question. The whole tragedy could have been minimized had there been greater comprehension earlier of the interdependence of technical and political considerations.

In 1951 there was a catastrophic flood in the centre of US along the Kansas and lower Missouri River. The damage cost one thousand million dollars, mostly in a great river-bank commercial city—Kansas City, through which the entire Kansas drainage funnelled. The Corps of Engineers had, at the time of the flood, just completed floodwalls and embankments in Kansas City. They had also asked for the building of a great flood detention reservoir just above the city. But the reservoir was not actually built because of resistance from the determined local landowners, who brought effective pressure to bear on the state and national legislatures. Without detention in the reservoir, the flood overtopped the Kansas City floodwalls and the disaster

came. Curiously enough, even after the 1951 flood Congress still failed to provide the annual budget demands to carry forward the construction of the reservoir. Public opposition in the reservoir constituency was so keen that it defeated for re-election one member of Congress who was alleged to accept the need for the dam. The District Engineer in Kansas City felt, as a technical man, he could only proceed with repairing the local floodwalls, while he warned people that, without the reservoir, the 1951 disaster could recur. Then, in 1955, there came to Kansas City a new District Engineer. He said to his political superiors, "I am responsible for the protection of Kansas City. It is physically impossible without the flood detention dam. Therefore, it is foolish to replace these floodwalls in Kansas City and all these miles of embankments, unless we are also building that dam. In another great flood, these local works would again be washed away." He would not ask for grants for any flood control work below the proposed dam. The effect on Congress was amazing. By that simple administrative decision he had changed the political question as they understood it. Formerly, regardless of what the engineers said, they had conceived of the embankments and floodwalls as a decision separate from the storage dam. Now an engineer not only talked but acted on the assumption that these were inseparable parts of one scheme. He changed the actual question they confronted, and they promptly rendered a different decision. In 1956 construction of the dam went ahead—now it is holding potential floodwaters.

The point is that this engineering officer had to

take a risk of political controversy and attack to do his own proper job—the job of putting up the right engineering proposal for political decision. He did it not because of, but in spite, of the conditions and traditions of his closed career service. For the normal product of this service would say, as all his predecessors did: “I am only posted here in Kansas City for two years. I am a career man and an engineer. I must not get caught in political charges and counter charges. The issue has taken an unfortunate form. But I am warning the people and the Congress of the danger. That is the limit to which a member of an engineering service should go.”

V

I come now to the most important of the questions raised by the closed career *versus* the open position systems: their relative capacity to promote and harness the specialization of labour. In considering this matter, you must make up your mind whether you are dealing with a fixed stage of specialization. It is one of the characteristics of economically developing countries that in them specialization is going on continuously and indeed at accelerating rate. Thorstein Veblen, writing about the technical man and particularly about the engineer earlier in this century, said that the US had even then entered an entirely new era. Specialization of labour was occurring even within a single generation. For the first time since technological innovation began with man's first use of tools, the skills which a man acquired in his normal period of youthful training assuredly would no longer be the

skills which he would need at the time of his maximum vocational or professional contribution.

What was true in America by 1921 is most certainly true in India in 1959. Specialization in engineering will not stay the same from the time a man is in college but which will continue to go on during the remainder of his life. In one respect there is even more rapid change in the kind of jobs that engineers do here in India than is going on in the highly industrialized countries. For Indian engineers are just now evolving new uses of large volumes of labour and small amounts of mechanization, introducing new combinations of men and machines on almost every new project. Here in India, engineers are exploring new frontiers of construction techniques—for example building high dams with surkhi-cement mortar, or of rubble masonry. The pace of change in the profession may thus for some years be more rapid than in the United States. The closed career system carries with it the danger that the kind of specialization which will be recognized is the kind that was extant ten or twenty years ago when the man entered into that profession. This is true for two reasons. One is that because the closed career system is closed. People who have developed new specialties cannot be freely brought in from outside. It is also true because of the recognition of the man inside the service will naturally tend to some degree to depend more on his all-round capacity to handle any job that falls to the service than on the specialties he has developed. To put it in another way, new specialties will be provided for within a closed service, but only after a lag of some years behind the outside labour market. This is true

because the man in such a service tends to be looked on from the point of view of rank, not so much so necessarily as in the United States Corps of Engineers, which is military, but perhaps as much as in one of the other closed career services in India such as Indian Administrative Service or Indian Police Service. And while giving recognition to a man from the point of view of his standing in the entire service may work well in the general services like the IAS, it may not take advantage of this progressive specialization of labour which is going on very rapidly in the field of engineering.

There ought to be in India in the next ten years' time very important new varieties of engineers—not new in the sense that there is none new, but in the sense that there is not yet a large-enough band to be recognized as part of any particular service. For example, consider the kind of engineer who is to be entrusted with the agricultural use of irrigation work. Might not this be a group of people whose importance will be of the very first order within ten years from now? Then what about the soil conservation engineers? Soil conservation consists of thousands of small projects. Perhaps for this the full skill of engineering is yet, as one observes them in India, to be brought to bear. As to the fields of electrical and mechanical engineering, consider the almost non-existent atomic energy power engineer. And yet India is planning to build very large electrical generating stations using nuclear fission in the Third Five Year Plan.

Up to this point the focus has been on the United States. The use of the American experience in India is to raise questions, not provide answers. But this comparison of two American approaches to organizing a

service of river development, along with other data that might be presented, certainly raises some questions about the proposal for an all-India Service of Engineers.

The contributions which such a service could make to heightening the prestige, toning up the moral standards, and increasing the relative compensation of engineers are very attractive. The argument that engineers who finish one dam need assurance they will be employed at another wins one's immediate sympathy.

On the other hand, one is driven to ask these questions about an all-India service of Irrigation and Power or River Development Engineers : Would the creation of such a service at this time widen or narrow the present gap between the planning, design and construction of major irrigation systems and their use to grow food or other crops? Would such a service strengthen the ties of mutual understanding and confidence between the Ministry and the top administrator in charge of major irrigation and electricity projects in each State? Or would these ties be strengthened rather by the evolution in each state of organizations suited to its river project, appropriately mingling in them engineers, utilization men, and broad administrators as illustrated by the Nagarjunasagar Control Board? Could a Service be administered so as to be responsive to the accelerating rise of new specialities and marginal fields of engineering? Can engineers fairly claim or fully qualify for the highest administrative and political posts guiding the great work of river development in India as they deserve to do, and the country needs them to do, unless they rise through services open to all doing the job best, and dedicated to river development, not only engineering?

V

THE RIVER VALLEYS AS PLANNING UNITS

IN the nineteenth century, the Industrial Revolution in the western countries of Europe had sufficiently run its course so that some of the deepest thinkers of England and France began to be concerned about the old relations between mankind and nature. In France, impetus was given to this line of social philosophy by the geographer Le Play, who said that we can define civilization in terms of work, mind and place. By this he referred to the importance of the physical setting in which civilizations shape themselves.

In Edinburgh and later in England, a planner, a social theorist of a very original turn of mind, Patrick Geddes began to inspire young men to consider the physical potential within which the whole of the economy and culture also has its growth. This man is known to you in India because he came to this country on commission to some of the Princely States to introduce city planning. Geddes suggested, as one of his many inspirations for a fresh view of man's relations to his environment, the concept of beginning at the headwaters of a drainage basin and following the course of the stream down to the largest cities that lie near the mouth. In this way he suggested, we may comprehend the relationship that man's complex economic and social entities have to the physical environment which gives them sustenance. We can guess that his highly individual thinking on this

score was better suited to the small watersheds of England or Scotland than to the great drainages of India or America. He himself did not apply this concept of the river valley as the area within which to comprehend the physical basis of the economic and the social life to actual planning. Perhaps it was too early for him to have in his mind these techniques of using river control for far-reaching and multiple economic benefits. He inspired an American—a man also of very wide social vision, Lewis Mumford, to apply this concept to the process of planning and development. In a book called *The Culture of Cities*, Mumford eloquently presents the thesis that the river valley is peculiarly suited to be the region within which all development activities can be envisioned and carried through. He gives considerable attention to TVA, which in the late thirties when the book appeared, was showing dramatic results.

Mumford's work has inspired many men to say that we should take hold of our planning problems intellectually and administratively in terms of river basins. You may, therefore, wish quickly to review the subsequent thinking on this score in the United States. After TVA had begun to do its work, there was a move in the USA toward doing what Mumford suggested—to divide United States into a series of major river valleys and to organize the federal activities for all natural resource developments under special government authorities for these river valleys. A bill was actually introduced in the United States Congress in 1937 to accomplish that. But it was not clearly supported by Franklin Roosevelt, who as President had inspired a great deal of earlier thinking along this line.

The bill was defeated, and no truly responsible proposal had been made along this line in the United States since.

One reason is that very sober consideration was given to the question of the river valley as a general planning unit by an authoritative body of practical and theoretical thinkers on this subject in the year 1935. This body was established within the National Resources Committee (later named the National Resources Planning Board) which was, while it survived, America's nearest counterpart to India's Planning Commission. Franklin Roosevelt organized it in the early days of the New Deal to get planning advice on the many new development activities instituted to bring us out of the depression. The report is entitled "Regional Factors in National Planning and Development". The authors under the chairmanship of Professor John Gaus, and including other professors and government planners, first examined the question of the existing area-wise developmentalization of the United States Government. They showed quite clearly, and illustrated it by a series of maps, that each central department and even each bureau within each federal department, maintained a system of territorial divisions and field headquarters peculiar to its own programme. Quite naturally the Reserve Bank has one set of field offices and the Soil Conservation Service within the Central Agriculture Department has another. Secondly, this report raised the question whether there were physical units within nature itself which might come to serve the purposes of over-all resource planning. With regard to the river valley as a planning region, the geographers on the committee pointed out that as far

as the nature is concerned, the Tennessee Valley is a most heterogenous area. On its eastern edge, the Tennessee Valley consists of unbroken woodlands, as much as 6,000 feet in altitude, with a very heavy rainfall and no agriculture. As one proceeds downstream, one comes to an area on which maize is grown on hillsides. As the river moves to the Mississippi, it runs through flat cotton lands. The only natural unity in the river valley is that of the flowing water. If one looks at forests, the natural unity is in the uplands from which three or four rivers may flow. If one looks at crops, there are other regions, others for minerals, others for weather. If you draw a map of the crop areas and on top of that place a map of mineral areas, then the forest areas, then the river valleys, you fail to get any general conformity in one set of boundaries with another.

Finally, the committee asked whether in the absence of any single set of planning regions, implicit in nature, the cultural or economic cohesions among people might suggest one. Here a little more progress was possible. Maps were juxtaposed showing the circulation of radius of newspapers, wholesale marketing areas, the supply of milk, and many other such economic and social transactions. There was a partial conformity, a conformity representing the influence of the great metropolitan centres. Chicago or Denver, for instance, is a centre for hundreds of economic and social activities. To this extent certain commanding metropolitan cities can be taken as common centres for a number of Government field offices. The curious and interesting point is that this is true of those government activities which have the least direct connection with the natural resources. In the United States

regionalization seems to be something that people create for themselves rather than something which is dictated by nature as such.

II

Serious and sincere thought has been given by a few people in India to the question of turning river basins into all-round planning units. One archaeologist, a fine scholar in his own field, put this suggestion as an alternative to linguistic loyalties. But there is nothing that I know in the Indian situation to contravene these considerations which I have laid before you from recent American thinking. Now if this be true, it would remove from our minds the conception of the river basin as the region for planning the development of all those phases of the economy which depend on natural resources.

Then what can be said in a constructive way about the proper business of a river valley development programme or a river valley development administration? I deliberately use these general terms—programme and administration—so as not to suggest that I am taking any position on the issue of the river valley corporation *versus* board of control. My subject is rather the scope of development which should be given over to either one of these river valley devices.

The best way to think what a river valley administration can best do is to think of the physical process of the flow of water down to and in the river. For a river basin or the river valley, as far as the nature is concerned, is nothing more than a place in which water falls and through which it circulates. If we begin our

thinking with the fall of the rain the first problem is to know precisely how much water will fall, or is falling. This is a business of the meteorological department; it is obviously not effectively organizable along river valley lines since rainstorms are no respecters of watersheds. And yet, it is perfectly true that the officers who give orders to open and close the sluice gates of a multiplepurpose reservoir need to have information quicker than usual and more detailed than usual, on the rain that will enter that reservoir. What is needed is not to turn meteorology for each river basin over to a basin agency, but to give that agency some means of getting special help from the nationwide meteorological service.

The rain falls on the land. The first question here is: Who is to draw the very detailed topographic maps without which the river basin engineers cannot locate or design their reservoirs or canals? The Survey of India, like the United States Geological Survey, is too competent in this field to displace; yet here again, the river plans need more detailed maps, decades sooner, than the Survey could provide in its normal programme. Again, short of consolidation, some adjustment must be made between these two programmes.

Rain comes down on forest, on cultivated land, or on barren land. There is obviously an influence at the very beginning on the circulation of that water through the nature of the vegetative cover on the soil. For instance, if forests can be retained or restored on part of land, you may get a more even out-flow of water through the wet and dry months of the year. Forests do not in any significant way increase rainfall, though that is widely believed, but they do develop deeper soil,

and their roots open it to the soaking in of rainfall, so that like a sponge, the soil stores more water. The relation between forestation and river flow is complex, and not fully understood. But even assuming that forestation improves flow, forestation probably ought to be administratively organized for the forest area as a unit and not for the drainage basin as a unit, because as we clearly see on the Western Ghats or the Vindhyas, or the Himalayas and their foothills, the natural area of a great forest cuts across the headwaters of many rivers.

Now let us consider the water that falls on the wasteland or crop-land. Some enthusiasts contend that the river valley agency should control soil erosion, because silt washed off the land fills up the reservoirs. If the reservoir is small, siltation may indeed control the economic justification of the dam. If the reservoir is very large, siltation is much less likely to be crucial. In any event, the principal economic justification of soil erosion control is likely to increase future crop yield that is got off that soil, and not the amount of water or the amount of silt that it puts into the river system. If we are candid we must recognize, nonetheless, that much nationally valuable initiative toward soil erosion work, and even forestry, has come from the more broadly chartered river agencies. Here again we need a way in which this initiative can stimulate the general government programme of soil erosion control or aforestation without deciding that the river valley development people must do the work.

Water runs through the main stream either over the surface or through ground water streams. In the main river this water can best be controlled by a single

brain. This is true because it is inherent in modern multiple purpose reservoirs that utilization of the water to hold back floods, to irrigate and to generate electricity must be synchronized very closely. If the rain gauges show a flood is on its way down from the headwaters, there may be only a few hours available to open the undersluices to draw down that reservoir in order to make for excess flow. Otherwise, the flood may spill over the reservoir and cause some damage below. If the reservoir can be quickly drawn down by a single water manager, or water dispatcher, space may be found in that reservoir to contain the entire flood, and that flood may be released gradually from that reservoir to generate power, to irrigate farms, or to fill up navigation channels downstream. I need not trace all the possible decisions of water management. Where dams are built for the most economic exploitation of all purposes, where the full course of a river is being brought under human control, as it is on the Krishna, the Cauvery, the Damodar, the Ohio, Colorado, Columbia, Missouri or the Tennessee, this control to be both safe and fully productive has to be dealt with by a single process of administration. That unified administration should include the process which controls water physically and which generates from the controlled water all its economic goods namely, hydro-electricity, supply for irrigation, industrial and municipal supply, and provision for navigation. All these things, it seems to me, have got to be directly under the river valley development administration.

Let us carry our thinking a little farther by visualizing the water as it runs out from the reservoir into an

irrigation canal. The construction of the canal has got to be subject to the same top administrative direction as the construction of the headworks. Completion of the two must be closely co-ordinated in time; otherwise a heavy investment stands idle. As the water goes through the canal system, each of the regulating gates may be opened or closed, having in mind the total supply and the levels that must be maintained at each sluice over the hundreds of miles from head to tail. So the whole system of headworks and canal is, without debate, put into the hands of the river development administration, whatever, in fact, it may be called. But when irrigation water leaves the outlet sluices the actual control of the flow and usually the construction of the ditches goes into other hands. We spend one of our nights examining how these other hands, that is the hands of cultivators, may be brought into some co-ordination with the river development administration. To summarize our conclusions on that score, we have found that apart from having the river development administration do the work of utilization, we want more clearly to get the cultivators themselves to assume the charge of utilization. In order to reach that happy condition, however, many other types of government workers are required to organize them with all the facilities, and to give them technical advice from an agricultural point of view. If that work is not timely done, then the river development administration—the Chief Engineer or the Board of Control or the Corporation—will receive the blame from the policy-makers who have accepted their project report with its economic justification based upon a certain programme of utilization. And

here again, in the process of utilization you are called upon to invent some linkage between these agricultural development agencies and the river development administration. Whose responsibility is this?

The same problem arises in the marketing of hydro-electricity, or of industrial water supply. Who is to undertake to stimulate the influx of industry for the utilization of power? It should be the kind of industry which would make the maximum use of the water resources or the mineral in that area. This work is closely involved in the development and utilization of the river and yet it is a kind of work, professionally speaking, that has very little to do with building or operating canals. Let us pause to consider electricity generated from steam. It is related to the river only in the important matter of the supply of water for cooling. Economically considered, however, thermal power interlinked with hydro-electricity, so that each takes up the load at particular times of the day, week or year, is often cheaper than either alone. This inter-change can be worked out between independent department agencies. However, it is characteristically the provision of huge inexpensive supplies of hydro-electricity which gives a sharp new upward turn to the total demand of electricity. Thus even after the demand outruns the capacity of all the dams, the further building of thermal plants to meet this demand may fall to the lot of the hydro-electric agency. This was a history of the TVA and it is turning out to be the history of the Damodar Valley Corporation. Whoever controls the main transmission net usually gets this responsibility. Going still farther afield, who is to undertake the planning of the physical sites of

cities as they begin to grow? This task has almost no connection either with the professions or the functioning of river development; yet certainly one of the influences, which is responsible for the growth of cities, is keeping the river safely within banks and generating cheap electricity and plentiful year-round water supply.

III

We can state certain conclusions at this point in our exploration. There is a core of work which cannot be severed from river valley administration. It consists of the controls of the flow of the river and the delivery of the products of that controlled river in the form of electric power and water to farms and cities and industries. Aside from the actual control of the river itself, we find that the functions of data gathering which are vital to the design, construction and operation of the river valley development administration must be speeded up and intensified as compared to the nation-wide rate of performance. At the other end of river development, the utilization of electricity and water is essential. The mobilization of the consumers demands some kind of extension service. Utilization also requires the solution of many specific problems—credit, marketing, seeds, fertilizers, transportation, equipment. These are all parts of ongoing national programmes in areas outside the river development too, and they should be. If these are not available in requisite volume and at just the right time, river development administration would be blamed for not getting its products into use. Its economic justifica-

tion will be upset. Finally, there are the broader development activities. Utilization of water and power facilitate them and they in return facilitate the marketing of water and power. But they are resultant of many other forces, too. Examples of these broader functions are soil conservation, the development of small industries, the variation of crops, the planning of industrial estates, recreation at the new reservoirs. What is to be the responsibility of river valley development for these functions?

The above conclusions explain why at the very outset of these lectures I said that river valley development is a fascinating problem in public administration. You cannot create the proper relationships of its varied ingredients by subjecting them all to one boss. How else can it be done? It is precisely the kind of question that public administration can tackle, and I believe, answer, if the problem is clearly foreseen.

Consider, for example, appropriateness to this particular situation of what I choose to call the river *basin budget*. Its usefulness may be illustrated in regard to the development of the Missouri River basin under the United States Department of the Interior. This Department corresponds to what you call a Ministry of the Central Government. It is large and not homogeneous. It has in it the agency which builds the dams and the canals for irrigation and hydro-electricity in the western half of the USA, the United States Bureau of Reclamation. Within the Interior Department, this Bureau properly receives most of the grants voted for the development of the Missouri River. The US Bureau of Reclamation also gets several million dollars each year which the law clearly

states is to be redistributed by the Bureau to other government agencies who perform the related and necessary auxiliary functions. Each year, from this basin budget, the US Geological Survey receives between one and two million dollars to speed up its topographic mapping within the boundaries of the Missouri basin. Exactly the same situation holds with the US Bureau of Mines, which is allotted a small amount each year from the basin budget. It uses part of the extra money to find mineral resources, in this basin, another part to try out the use of lignite, like that of Neyveli, to generate electricity. All this is quite easy to do once the legislature turns over the money to the principal basin development agency to redistribute among other agencies which should be co-ordinated but not merged with it. It is absolutely necessary to do if you are to coordinate the directly related with the indirectly-related activities.

In the case of TVA, this method of transferring funds is carried farther in getting the cooperation of entirely separate units of the federal government and even the governments of the states. TVA has no irrigation but it does have a large programme to improve soil fertility and thus raise farm income. It carries out this work entirely through what we call county agents—what you call Extension Services. It provides money to each county (about the size of a taluk) to employ an additional assistant county agent who works under the regular county agent in a special programme of soil improvement. TVA is a central agency and the county agents are part of the state governments which have no constitutional connection with it. The cooperation was simply agreed

to as being advantageous to both governments, and established in a written contract or agreement.

It is essential to this kind of arrangement that the legislature define properly in a statute exactly what practices the river development comprehends, but that the matter of handing out the money be left to the administrative agency. To make it perfectly clear you leave the cheque book in the pocket of river development agency because that is where you are going to put the responsibility if the auxiliary services are not provided in time.

The second administrative method for reaching the margins of river valley developments is the device of demonstration and proposal as to plans. If the Government expects the basin programme to move the economy ahead on a broad front and not merely in the river channel, it may very well give the river development administration not only the power but the duty to demonstrate and to make proposals upon certain activities which are not directly connected with the flow of water. One illustration will show how sensible, how practical, and yet how influential this is. The TVA has the business of developing navigation. The purpose is to expand the volume of transportation available and to reduce its cost. But this is not the only kind of transportation needed and in that part of the United States, as in most of India, the bulk of the goods must travel by rail. There were serious hindrances to rail transportation because the rates were unfairly high in the South East for the benefit of the original port cities of the United States—the area of Philadelphia, Boston, and New York. You may be able to sympathize with us in that difficulty.

All that the Tennessee Valley Authority had the power to do about freight rates was simply to write a report. That it did, upon the soundest conclusions of very able transportation economists. When the report was published showing the unfairness of rates, it aroused a good many Congressmen. Many industries were interested in locating or expanding where the transportation could be made cheap. The TVA's programme of water transportation had served to arouse the people to the importance of transportation costs. Within one or two years after the impact of this report had been felt, and after more than 50 years of traditional inequity, rail freight rates were suddenly reduced by the Inter-State Congress Commission—an entirely independent agency which had this in its power to do. The cost of these reporting and demonstrating activities is very small. The part it plays in the whole of river valley administration should be minor. Yet since the nation is after all spending a good deal of money to develop the physical resources of the river primarily to stimulate economic productiveness, it is a very practical thing to give the agency this responsibility to watch over the general progress of the economy to make reports or to conduct small and inexpensive demonstration if it feels that some problem has not been given adequate attention.

The third administrative tool is more difficult to understand and adequately appreciate. In its internal activities as a major employer, the river development agency has a tremendous power to influence some of the human conditions for industrial growth, economic development and for civic improvement in the area in which it operates. I will call this administrative by-

products of the river development administration. An example will give you an idea of the importance of this consideration. The whole Indian textile industry employs about one million people. If you put together the Central and State Public Works Departments, they employ 6 lakhs—more than half as much. If the State and Central PWDs were to become model managers of labour, then you could have an effect upon the industrial discipline of the people who are eventually to man the industries which are the object of much of the public works. Here again, I illustrate from TVA, because in America only TVA was given the responsibility to make use of its administrative by-products. When TVA came into its area in 1933, the disciplined organization of labour was unheard of. There were strikes; there were a few internal unions. There was no union which could sign a contract with and know that the workers represented by that union would abide by the terms of the contract; and there were no employers who accepted from their management-point the value of such a contract. The TVA was the first to do it. But its operation was sufficiently large over a large area so that it served as an object lesson to other managements. Moreover, the successful experience that responsible trade unionists had been negotiating with TVA brought an entirely new crop of union leadership to the foremen who were stable leaders rather than agitators. This, in turn, made the outside employer look with assurance at the matter of bringing his plant into that area. Labour hitherto unaccustomed to industry had demonstrated that it could work in a disciplined situation with its own representative trade union organizations.

The TVA might have got its dams built by turning its work over to small contractors, and thus washed its hands off labour relations. That certainly would not have conserved this by-product value.

There is another related approach which I do not endorse. Some enthusiasts of river valley development believe that every facility you construct has to be a model of some kind: that every village in which you move the people should be a model village, that every rest-house which you build for the entertainment of those who visit your project should be a model hostel. The decisive question about models like this is not whether they demonstrate precisely the kind of economy the nation is trying to develop. If not, the false standards are far more expensive than the cost of the model itself.

IV

So far, we have sampled some of the devices of public administration to build a link between what must be a unit of river development administration—controlling the river, generating its products, and taking them to the user—and what must remain structurally independent—the other national programmes for resource use and economic development—that nevertheless have a great deal to do with the products of river valley development. The creation of this link is up to a matter of administrative know-how alone. It has always a different pattern of linkage for each river basin because each river basin offers a different potential in nature and because it offers a different potential of utilization on the human side.

Historically, the defining of this linkage has in fact been only done by the hard struggle of few policy-makers of uncommon patience. At an early stage, they got this notion into their minds and worked for numbers of years together in order to persuade their colleagues in the Ministry, in the Department and in the Legislature that if this linkage were created, the river could be made to serve human need reaching far beyond its own banks. In my country, for example, one man who discovered such a connection and who devoted much of his life to revealing it to the policy-makers of the government was Major John Wesley Powell. In the 1870's, he went out into Missouri basin, the Colorado basin, the Great Basin of Utah and found the crucial link between the supply of water and proper utilization of the soil—a grazing and not a crop growing economy. Few in the United States Congress would believe him. They declared this area could be ploughed up like the rest of the country and put into wheat. Powell, who was the first director of the US Geological Survey, insisted that there would not be, year in and year out, enough rainfall for that. The proper size of the farm is not 160 acres, he stubbornly maintained, though the rest of the American frontier had been settled on that pattern, but 2,560 acres. He was hounded out of office by the grandiose planners who wanted to develop a standard type of agriculture over the whole country. That was half a century ago. Meanwhile the country was ploughed up against his warning. And so, in the great droughts of the 1890's and 1930's, in every 2,560 acres, we had a dozen or so farmers who lost both crops and homes and left those sub-humid regions. The farms were

gradually enlarged by the bankruptcy of many original settlers. Today, we find a grading economy in those basins adapted to a limited water supply and finally arrived at by a painful process of human disaster.

Take the case of George W. Norris, Senator from the Nebraska. In 1923, he brought in a TVA bill and laboured for getting it passed. For ten years, he had no hope at all for getting it through. And the people of the Tennessee Valley were his bitterest enemies. The reason was that Norris had come to see that the potentiality of the Tennessee River lay not in making cheap nitrogen fertilizer, as farmers then believed, but in generating cheap electricity and making phosphate fertilizers which had not then been tried out. Only when Franklin Roosevelt became President, he had a chance of taking his TVA bill, explaining the sound connection between river and soil. Roosevelt championed the bill. It was enacted in 1933—ten years after Norris had begun his struggle. This is not an easy kind of thing to do; it depends upon vision and political sagacity as well as administrative knowledge.

It is one of the real satisfactions of a river valley engineer that he can see what he has done. There in the river is a great piece of concrete or masonry. A great man-made river flows out through the sluices. His countrymen come by the lake to look at it; they respect the men who did this job. But the real results are not created by the piece of masonry or the man-made river. The real results come from the thousands of men in cities and villages who have the enterprise to take advantage of the electricity to turn the lathes or the looms or the sugar mills, and thus to make

more employment and more wealth for the country. The results come from the cultivators who have the enterprise to take that water into their crops and to put on green manures and thus to double their yield. These are the people who really do the job of development.

What you do, if you have political vision and administrative knowledge, is to extend not only the basic facilities but also the stimulus of the controlled river to them. You extend the power of initiative of river development administration far beyond its power of control. That is a kind of reciprocal of what we saw earlier, that you devise means also to admit the purposes and decisions of these millions of people who bring development to fruition into your planning for the river's use. In that sense, you keep project decisions responsive to their initiatives. That is the ultimate connection between river and region—a river valley region is made by people working together to use a river. It is a product of democratic administration, worth a good deal of troublesome thought.

INDEX

- ADMINISTRATION, unified administration of river dams, 94
- Administrative authority, legal power to, 60; knowledge, 105, 106; organization and supervision, 59; educational system, 59
- Agricultural College, 58, 59; credit, 54; credit co-operation, 58; development agencies, 96; economic problems, 58
- Agriculture College in research and education, 57, 59; co-operation in, 54-61; departments, 59
- All India Service of Engineers, purpose for river development, 86
- All India service of irrigation and power, for irrigation system, 86
- Andhra University, conducting of socio-economic survey, 57
- Appleby, Dean Paul, 14
- Balvantray Mehta Study Team, future of the community projects, report, 50, 58, 63
- Bhadra project, 36
- Bhakra project, 36, 76
- Bihar, gird, 11; nominee to DVC, 9
- Bills, *see under* Respective Bills
- Biography of a "Rivers and Harbours Bill", 46n
- Board of control, of the project for policy making, 95
- Bonneville, multi-purpose reservoir, 36
- Boulder dam, act, 48; development of, 35
- California, Central Valley of, *see* Central Valley of California
- Canal system, 2, 48, 50, 51
- Cautley, Captain, 65
- Cauvery river, project on, 36, 94
- Central Public Works Department, 102
- Central Valley of California, 33; river development of, 35
- Chicago, Center of Economic and Social Activities, 90
- Civil Service, 23; Act, 72; definition of, 65
- Clapp, Gordon, 68
- Closed career service, 80, 83, 84, 85; limitation, 80, 84; *see also* Tennessee Valley Authority, Staffing, Closed career
- Collective responsibility of irrigators, 60
- Colorado, basin, 104; dam, 76; river development of, 35, 94; valley, 71; *see also*

- Lower Colorado
 Columbia, basin joint investigations, 57; river development of, 35
 Compromise, process of, *irt* legislature of public interest, 44
 Congress, *see* United States Congress
 Connecticut, river development of, 35, 42
 Central Board of Nagar-juna-sagar Project, 57
 Corps of engineers, *see* United States Corps of Engineers
 Corruption, problem of, 74
 Curtis, Harry A., 70
- Dam, construction of, 2, 15, 16, 18, 73, 82, 84; economic use of, 94, 95; hydro-electric dam, 79
 Damodar ayacut, 52; river, 94; valley, 37
 Damodar Valley Corporation, Act, 8, 13, 48; administrative set-up; construction of, 18; electricity, 7; enquiry, 19; irrigation project, 7; launching of, 1
 Davis, Calvin, 69
 Denison, multi-purpose reservoir, 36
 DVC, *see* Damodar Valley Corporation
- lem, 58; assessment, 28; co-operation with engineering, 29, 30; decisions, 35; depression, 67; evaluation, 29; factors, *irt* basin, 1; justification, 94, 95, 97
 Eisenhower, Dwight, 8
 Electricity: demand for, 6; distribution of, 10, 11, 12; generating stations, 85; supply of, 10, 11, 12; utilization of, 97, 98
 Engineer's Seminar, 54n
- Farmers, co-operation among, 54-61
 Flood control, 6, 30, 42n, 43, 46, 47, 78, 82
 Flood crisis of, 48; damage, 32, 39, 40, 42; occurring of, 37
 Fontana, multi-purpose reservoir, 36
 Friant, multi-purpose reservoir, 36
 Fort Peck, multi-purpose reservoir, 36
- Gandhi, Mahatma, 21
 Gandhi Sagar project, 36
 Gaus, John, 89
 Geddes, Patrick, 87
 Grand Coulee, multi-purpose reservoir, 36
 Grand, Ulysses S., 74
 Great Basin of Utah, 104
- Economic, Agricultural prob-

Hari Singh: Utilization of Irrigation Potential in DVC, 12n
 Harnessing of rivers, 6
 Hart, Albert Busnhell, 46n
 Hart, Henry C. : *Crisis, Community and Consent in Water Politics*, 31n
 Hirakud project, 36, 52
 Hiranandani, M.G., 54n
 Hoover Dam, Act, 48; completion of, 36
 Hoover, Herbert, 76
 Hydro-electricity, supply of, 94, 96

I.A.S., *see* Indian Administrative Service

I.C.S., *see* Indian Civil Service

India : administrative achievement *irt* river valley, 3, 5; agricultural credit co-operatives, 50; all-India service of engineers, 86; all-India service of irrigation and power, 86; British East India Company, 65; Centre relations with State, 86; Central Ministry, 9; Central Water and Power Commission, 27; closed career service, 85; constitution, 52; co-ordination Board of Ministers, 28; democracy, 62; electrical generating stations, 85; farmers, co-operation in, 50, 54-61; Finance Ministry, 17; Five Year Plan, 61-63, *irt* floods 43; Five Year Plan, First,

62, 63; Second, 27; appraisal and prospects of, 55n; *irt* agricultural credit co-operatives 50; Five Year Plan, Third, 27, 85; irrigation, coverage, 49; Irrigation and Power Ministry meetings, 28; machinery for decision, 26-28; multi-purpose reservoirs, 36; North India, 65; Parliament, 45, 46; parliamentary delegation, 28; Planning Commission, 27, 28, 60, 61, 89; Princely States, 87; provisional government, 13; public works departments, 27; river development engineers, 86; Survey of, 92; Zonal Councils, 28

Indian Administrative Service, 75, 85

Indian Civil Service, 22, 75, 78

Indian Council of Agricultural Education, 59

Indian Council of Agricultural Research, 57

Indian Police Service, 85

Indian service of engineers, 65

Industrial water supply, problem of, 96

Interstate Congress Commission, 101

Inter-State Water Disputes Act, 28

I.P.S., *see* Indian Police Service

Irrigation : Administrative services, provision for, 54; variation of, 56; canals, 49, 51; economic justification of, 94,

- 95; economic value of 57; local institutions, establishing and maintaining of, 54; *rabi* irrigation of, 11; tanks, 51; technique of, 55, 56; utilization of water, 49, 54n, 59, 62; wells, 51
- Irrigation and power, 86; Seminars, 4, 52, 57, 62
- Irrigation Project, proposals, 60, 61

- Jackson, Andrew, 25, 72, 74, 75

- Kansas, 81; city, 81-3; dam, construction of, 82
- Kosi barrage and embankments, 29
- Koyna project, 36
- Krishnarajasagar project, 36
- Krug, Julius, 76

- Lal, S.B. : "Utilization of Irrigations Potential in DVC", 12n
- Leuchtenburg, William E., 42n
- Lilienthal, David E., 9, 13, 14
- Lincoln, Abraham, 38
- Lower Colorado of Texas, river development of, 35
- Measure to accelerate utilization of water, 54n
- Metha, Balvantray, **see* Balvantray Metha Study Team
- Mississippi, river development of, 35, 38, 90; Lower Mississippi, 71
- Missouri, river basin, 98, 99, 104; river development of, 35, 81, 94
- Morgan, Arthur E., 19
- Multi-purpose co-operation, 50

- Mumford, Lewis, 88
- Nag, B.S., 62
- Nagarjunasagar, Central Board, 86; project, 36, 57, 63
- National academy, West Point National Military Academy, 72
- National Development Council, 57; Standing Committee, 55n
- National Military Academy, West Point, 72
- National planning and development, regional factors in, report, 89
- National Resources Committee, 89; planning board, 89
- Norris, multi-purpose reservoir, 36
- Norris, George W., 105

- Open position system, 83; *see also* Tennessee Valley Authority, Staffing
- Maithon project, 36
- Marshall Ford, multi-purpose reservoir, 36
- Mayurakshi project, 36

- Panchet Hill project, 36
 Personnel, 15, 16; military personnel, 66, 71, 73; specialization of, 83, 84; technical, 15, 16, 20
 Plan : Flood control project, 47; for the project, 27; problems of planning, 88
 Play, Le, 87
 Powell, John Wesley, 104
 Public administration : devices of, 103; problems of, 2, 98
 Public interest: crisis, 41; factor, 30-34; corollary to, first, 40; second, 41; criticism 35; latency, 38; national public interest legislation, 44; reasons, 41; study of, 34
 Public works departments, Central and State, 102

 Rain, different stages after falling, 92
 Rao, K.L., 62
 Regional factors in national planning and development, report, 89
 Reserve bank *int* agricultural credit co-operative, 58, 89
 Reservoir, maintenance of, 93, 94
 Rihand project, 36
 River, basin budget, 98, 99; Boards Act, 28, controlling of, 9; development administration, 91, 94-7, 100, 103, 106; development engineers, 86, human control over, 94; physical resources of, 101; processes of its formation, 90-92; unified administration of, 94
 River Valley : agency 93; Corporation 91; development administration 91, 94, 95, 97, 98, 101, 103; development programme, 91; planning of, 88, 89
 Rivers and Harbours Bill, 46
 Roosevelt, Franklin, 26, 88, 89, 105
 Roosevelt, Theodore, 26
 Rural credit movement, 54; condition for, 54-7

 S.C.S., *see* Soil Conservation Service
 Selznick, Philip, 14
 Shasta, multi-purpose reservoir, 36
 Singh, Hari, *see* Hari Singh
 Slover, George, 67
 Social cohesion, 32; problems of, 51; social differences, 21
 Soil Conservation Service, 56, 85, 89
 Soil erosion, Control of, 93; soil fertility, 99

 Tawney, R.H., 23
 Tennessee, river development of, 35, 69, 94, 105; Valley, 90, 105
 Tennessee Valley Authority, Act, 8, 12, 48; Bill, 105; Board of Directors, 68, 70;

- chemical fertilizer plant, 7;
congressional enquiry, 19;
corps of engineers, 68; dams,
67, 70; law, 8; personnel, 66,
68, 69, 70; promotion board,
73; staffing, closed career,
74, 78, 79; staffing, open
system and position system,
70, 73; staffing, rules for, 68;
staffing, system of, 67, 68,
70, 73, 74, 78, 79; thermal
power stations, construction
of, 67, 70
- Texas, Lower Colorado of, *see*
Lower Colorado of Texas
- Thermal power stations, 7; *see*
also Tennessee Valley Autho-
rity
- Thompson Engineering Col-
lege, 65
- Toynbee, Arnold J., 5
- Tri-country irrigation district,
56
- Tungbhadra, irrigation and
power, 29; project, 36, 52
- T.V.A., *see* Tennessee Valley
Authority
- Twain, Mark, 38
- Tygart, multi-purpose reser-
voir, 36
- U.S., *see* United States
- Union Public Service Com-
mission, 17
- United States: army corps of
engineers, 66, 70-73, 75, 76;
army engineer officers, 71-
3; Congress, 25, 81, 83, 88
104, *art* corps of engineers,
74; Congressmen, 101; corps
of army engineers, 8, 70-73,
85, 76; corps of engineers,
70-73, 75, 78, 81, 85; criti-
cism of, 74; district engine-
er *art* river development,
71-73; Economic depression,
67; engineering services, 66;
foreign service, 76; geolo-
gical survey, 92, 99, 104;
interior, department of, 76,
98; mines, bureau of, 99;
multi-purpose reservoirs, 36;
national resources committee
25; reclamation, bureau of,
55-57, 79, 98, 99; southeast
of, 100; War, Secretary of
25; water resources, 26
- Utah, great basin of, 104
- Utilization of water, problems
of, 97
- Veblen, Thorstein, 83
- Wager, 70
- Water drainage, causes of, 39;
water resources, symposium
on, 31; utilization of, 96-98;
measures to accelerate, 54n;
water transport, 101; water-
ways, 7
- Weber, Max, 5, 23
- West Bengal, 12, 13, 52; engine-
ers, 65; nominee to DVC, 9
- West Point National Military
Academy, 72

